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NASA/SP—1999—7037/SUPPL406  
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# **AERONAUTICAL ENGINEERING**

A CONTINUING BIBLIOGRAPHY WITH INDEXES



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Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract.

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- |    |   |    |
|----|---|----|
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|    | Includes all avionics systems, cockpit and cabin display devices; and flight instruments intended for use in aircraft.  |    |
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|    | Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.   |    |
| 08 | <b>Aircraft Stability and Control</b>   | 21 |
|    | Includes flight dynamics, aircraft handling qualities; piloting; flight controls; and autopilots.   |    |
| 09 | <b>Research and Support Facilities (Air)</b>  | 23 |
|    | Includes airports, runways, hangars, and aircraft repair and overhaul facilities; wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems. |    |

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|----|--|------|
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|    | Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; space communications, spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation and astronics; and spacecraft propulsion and power. |      |
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|    | Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and thermodynamics; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.   |      |
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|    | Includes geosciences (general); earth resources and remote sensing; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.  |      |
| 14 | <b>Life Sciences</b>   | 32   |
|    | Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and exobiology.   |      |
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A08	36.00	72.00	E08	165.50	331.00
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# Typical Report Citation and Abstract

- ① 19970001126 NASA Langley Research Center, Hampton, VA USA
- ② Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes
- ③ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhaert, Dan H., Lockheed Engineering and Sciences Co., USA; Mar. 1996; 130p. In English
- Contract(s)/Grant(s): RTOP 505-68-70-04

④ Report Note(s): NASA-TM-4663; NAS 1.15-4663; L-17418; No Copyright; Avail: CASI; A07; Hardcopy; A02; Microfiche

- ⑤ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10° to 50°, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65° swept forebody serrations tended to roll together, while vortices from 40° swept serrations were more effective in generating additional lift caused by their more independent nature.

- ⑥ Author
- ⑦ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

## Key

- 1. Document ID Number, Corporate Source
- 2. Title
- 3. Author(s) and Affiliation(s)
- 4. Publication Date
- 5. Contract/Grant Number(s)
- 6. Report Number(s); Availability and Price Codes
- 7. Abstract
- 8. Abstract Author
- 9. Subject Terms

# AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 406)

AUGUST 1998

## 01 AERONAUTICS

19990053503 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia  
Workshop on Helicopter Health and Usage Monitoring Systems

Forsyth, Graham F., Editor, Defence Science and Technology Organisation, Australia; February 1999, In English, February 1999, Melbourne, Australia. See also 19990053504 through 19990053520

Report No.(s): DSTO-GD-0197; AR-010-812; Copyright: Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P.O. Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

Over the last 10 years, helicopter Health and Usage Monitoring Systems (HUMS) have moved from the research environment to being viable systems for fitment to civil and military helicopters. In the civil environment, the situation has reached the point where it has become a mandatory requirement for some classes of helicopters to have HUMS fitted. Military operators have lagged their civil counterparts in implementing HUMS, but that situation appears set to change with a rapid increase expected in their use in military helicopters. A DSTO-sponsored Workshop was held in Melbourne, Australia, in February 1999 to discuss the current status of helicopter HUMS and any issues of direct relevance to military helicopter operations.

Author

*Conferences; Military Helicopters; Monitors*

19990053516 Ministry of Defence, Directorate of Helicopter Projects, Bristol, UK

Fatigue Usage Monitoring in UK Military Helicopters

Draper, Alan, Ministry of Defence, UK; Workshop on Helicopter Health and Usage Monitoring Systems; February 1999, pp. 153-166, In English; See also 19990053503; Copyright: Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P.O. Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

This paper describes the evolution of fatigue monitoring in UK military helicopters. The development of indirect mathematical relationships, to calculate fatigue damage from helicopter Health and Usage Monitoring System (HUMS) sensor data, is also discussed. The paper concludes with the concept of the Fatigue Usage Monitoring System (FUMS) management tool developed under contract from the MoD by MJA Dynamics, Hamble, UK.

Author

*Fatigue (Materials); Military Helicopters; Monitors*

19990053518 Naval Air Warfare Center, Propulsion and Power Dept., Patuxent River, MD USA

SH-60 Helicopter Integrated Diagnostic System (HIDS) Program Experience and Results of Seeded Fault Testing

Hess, Andrew J., Naval Air Warfare Center, USA; Hardman, Bill, Naval Air Warfare Center, USA; Workshop on Helicopter Health and Usage Monitoring Systems; February 1999, pp. 181-202; In English; See also 19990053503; Copyright: Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P.O. Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

The evolution of automated diagnostic systems for helicopter mechanical systems has been aided by a Navy program of systematic testing of drive train components having known anomalies (seeded faults) while simultaneously executing a suite of diagnostic techniques to identify and classify the mechanical anomalies. This program, called the Helicopter Integrated Diagnostic System (HIDS) has been carried out using an iron bird test stand (SH-60) at NAWC - Trenton, and SH-60B/F flight vehicles at NAWC - Patuxent River. The SH-60 HIDS program has been the Navy's cornerstone effort to develop, demonstrate, and justify integrated mechanical diagnostic system capabilities for its helicopter fleets. The objectives of the program were to:

1. Acquire raw data for multiple cases of "good" and seeded fault mechanical components on a fully instrumented drive train to

support the evaluation of diagnostic algorithms and fault isolation matrices. Data is being acquired from 32 vibration channels simultaneously at 100 kHz per channel while a continuous usage monitoring system records parametric steady state data from the power plant and airframe. 2. Analyze vibration and other diagnostic indicators to evaluate sensitivity and performance of all available diagnostic methods when analyzing well-documented parts. Evaluate relative effectiveness of these various diagnostic methods, indicators, and their associated algorithms to identify and optimize sensor location combinations. 3. Demonstrate the ability to integrate and automate the data acquisition, diagnostic, fault evaluation and communication processes in a flightworthy system. 4. Integrate and evaluate comprehensive engine monitoring, gearbox and drivetrain vibration diagnostics, advanced oil debris monitoring, inflight rotor track and balance, parts life usage tracking, automated flight regime recognition, power assurance checks and trending, and automated maintenance forecasting in a well coordinated on-board and ground-based system. 5. Provide an extensive library of high quality vibration data on baseline and seeded fault components. This data can be made available to anyone wanting to prove their diagnostic techniques or develop new capability. 6. Provide a "showcase", state-of-the-art, fully functional Integrated Mechanical Diagnostic system to act as a catalyst demonstration which might lead to interest in a fleet wide production application. This paper will describe the overall program, the goals and objectives, the facilities used, the system evaluated, the accomplishments and the results and conclusions obtained to date. The results of extensive gearbox and powertrain "seeded fault" testing will be presented. Lessons learned which can be applied to future Helicopter Usage Monitoring Systems (HUMS) and/or Integrated Mechanical Diagnostic (IMD) systems will also be discussed.

Derived from text

*Diagnostics; Faults; Helicopters; Performance Tests; Algorithms; Anomalies; Automatic Control*

19990058597 Royal Aeronautical Society, London, UK

The Aeronautical Journal, Volume 101

Stollery, J. L., Editor, Royal Aeronautical Society, UK; Baldwin, B. F., Editor, Royal Aeronautical Society, UK; Male, C. S. C., Editor, Royal Aeronautical Society, UK; Price, J. A., Editor, Royal Aeronautical Society, UK; December 1997; ISSN 0001-9240; 53p; In English; See also 19990058598 through 19990058602; No Copyright; Avail: CASI; A04; Hardcopy; A01; Microfiche

Contents include the following: An airborne windshear detection system. International obligations as regards safety in international civil aviation. Performance of straight-walled annular diffusers with swirling flow. Some aspects of centrifugal fan characteristics in blower windtunnels. Transonic flow over wavy walls: a new solution procedure compared with experiments. CASI

*Transonic Flow; Civil Aviation; Aerial Reconnaissance; Safety*

## 02

### AERODYNAMICS

*Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery*

19990053521 Royal Aeronautical Society, London, UK

The Aeronautical Journal, Volume 103

Stollery, John L., Editor, Royal Aeronautical Society, UK; January 1999; ISSN 0001-9240; 68p; In English; See also 19990053522 through 19990053526; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London W1V 0BQ, UK); Hardcopy; Microfiche

Contents include the following: Unsteady aerodynamics: retrospect and prospect. Shock phenomena in high speed aerodynamics: still a source of major concern. Unsteady flow around helicopter rotor blade sections forward flight. Pressure over a two-cavity cascade at supersonic speed. and Wavelet analysis of pilot workload in helicopter low-level flying tasks.

CASI

*Workloads (Psychophysiology); Wavelet Analysis; Unsteady Flow; Aerodynamics*

19990053522 Defence Evaluation Research Agency, Bedford, UK

Unsteady Aerodynamics: Retrospect and Prospect

Mabey, D. G., Defence Evaluation Research Agency, UK; The Aeronautical Journal; January 1999; Volume 103, No. 1019, pp. 1-18; In English; See also 19990053521

Report No.(s): Paper-003; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London W1V 0BQ, UK); Hardcopy; Microfiche

This paper reviews some current problems in unsteady aerodynamics and discusses some future challenges. The emphasis is on problems associated with separated flows, such as buffeting and limit cycle oscillations. Suggestions are made to indicate

how experimental facilities (such as cryogenic wind tunnels) and computational fluid dynamics might be exploited to address these questions.

Author

*Buffeting; Cryogenic Wind Tunnels; Separated Flow; Unsteady Aerodynamics*

19990053523 Office National d'Etudes et de Recherches Aérospatiales, Mermidon, France

Shock Phenomena in High Speed Aerodynamics: Still a Source of Major Concern

Delery, J. M., Office National d'Etudes et de Recherches Aérospatiales, France; *The Aeronautical Journal*, January 1999, Volume 103, No. 1019, pp. 19-34; In English; See also 19990053521

Report No.(s): Paper-2434; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London W1V 0BQ, UK); Hardcopy, Microfiche

Shockwaves are present in a flow as soon as the Mach number becomes supersonic. Being viscous phenomena, shockwaves are a source of drag which can be predominant when the Mach number is significantly higher than one. In supersonic air intakes the production of entropy by shocks is felt as a loss in efficiency. At high Mach numbers, shockwaves produce a considerable temperature rise leading to severe heating problems, complicated by real gas effects. The intersection - or interference - of two shocks gives rise to complex wave patterns containing slip-lines and associated shear layers whose impingement on a nearby surface can cause detrimental pressure and heat transfer loads. The impact of a shockwave on a boundary layer is the origin of strong viscous interactions which remain a limiting factor in the design of transonic wings, supersonic air intakes, propulsive nozzles and compressor cascades. More effort is needed to improve prediction of these interactions and to devise new techniques to control such phenomena.

Author

*Shock Waves; High Speed; Aerodynamics; Heat Transfer; Drag; Air Intakes*

19990053524 Cranfield Univ., Coll. of Aeronautics, Bedford, UK

Unsteady Flow Around Helicopter Rotor Blade Sections in Forward Flight

Shaw, S. T., Cranfield Univ., UK; Qin, N., Cranfield Univ., UK; *The Aeronautical Journal*, January 1999, Volume 103, No. 1019, pp. 35-44; In English; See also 19990053521

Contract(s)/Grant(s): EPSRC-GR/K31664

Report No.(s): Paper-2329; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London W1V 0BQ, UK); Hardcopy, Microfiche

The aerodynamic performance of aerofoils performing unsteady motions is important for the design of helicopter rotors. In this respect the study of aerofoils undergoing in-plane oscillations (translation along the horizontal axis) provides useful insight into the flow physics associated with the advancing blade in forward flight. In this paper a numerical method is developed in which the unsteady thin layer Navier-Stokes equations are solved for aerofoils performing rigid body motions. The method has been applied to the calculation of the flowfield around a NACA 0012 aerofoil performing in-plane motions representative of high-speed forward flight. Comparison of computed pressure data with experimental measurements is generally found to be good. The quantitative differences observed between computations and experiment are thought to have arisen mainly as a consequence of the low aspect ratio of the model rotor employed in the wind tunnel tests.

Author

*Unsteady Flow; Rotor Blades (Turbomachinery); Airfoils; Flight Characteristics; Fluid Dynamics*

19990053525 Southampton Univ., Dept. of Aeronautics and Astronautics, UK

Pressure Over a Dual-Cavity Cascade at Supersonic Speeds

Zhang, X., Southampton Univ., UK; Edwards, J. A., Defence Evaluation Research Agency, UK; *The Aeronautical Journal*, January 1999, Volume 103, No. 1019, pp. 45-54; In English; See also 19990053521

Report No.(s): Paper-2378; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London W1V 0BQ, UK); Hardcopy, Microfiche

Pressure distributions over a dual cavity cascade were studied at supersonic speeds of Mach 1.5 and 2.5. The study was performed through numerical modelling and results compared with model measurements. The Reynolds-averaged Navier-Stokes equations were solved using a finite-volume algorithm in which the inviscid cell interface fluxes were estimated using Roe's approximate Riemann solver with a second-order extension, and turbulence was modelled using a two-equation kappa-omega model with compressibility corrections. Two test configurations were selected: (1) a length-to-depth ratio  $L/D = 1$  cavity followed by another  $L/D = 1$  cavity, and (2) an  $L/D = 3$  cavity followed by an  $L/D = 1$  cavity. The prediction was compared with that of a single cavity of the same  $L/D$ . It was found that the pressure field around the  $L/D = 1$  cavity was substantially modified by a



preceding  $L/D = 3$  cavity. Changes in the pressure and pressure drag coefficient were observed. The study clarified some earlier observations of unsteady modes over a dual cavity cascade, and confirmed model measurements of the pressure fluctuation under a number of flow and geometry conditions.

Author

*Pressure Distribution; Cavities; Supersonic Speed; Research; Aerodynamic Drag; Mathematical Models; Navier-Stokes Equation*

19990053579 Duke Univ., School of Engineering, Durham, NC USA

Limit Cycle Oscillations (LCO) and Nonlinear Aeroelastic Wing Response: Reduced Order Aerodynamic Models. *Final Report, 1 Jul. 1995 - 30 Jun. 1998*

Dowell, Earl H.; Apr. 1999; 15p; In English

Contract(s)/Grant(s): F49620-95-1-0417; AF Proj. 3484

Report No.(s): AD-A362982; AFRL-SR-BL-TR-99-0125; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A nonlinear, aeroelastic analysis of a low aspect, delta wing modeled as a plate of constant thickness demonstrates that limit cycle oscillations (LCO) of the order of the plate thickness are possible. The structural nonlinearity arises from double bending in both the chordwise and spanwise directions. The present results using a vortex lattice aerodynamic model for a low Mach number flow complement earlier studies for rectangular wing platforms that showed similar qualitative results. The theoretical results for the flutter boundary (beyond which LCO occurs) have been validated by comparison to the experimental data reported by other investigators for the low aspect ratio delta wings. Also the limit cycle oscillations found experimentally by previous investigators (but not previously quantified prior to the present work) are consistent with the theoretical results reported here. Reduced order aerodynamic and structural models are used to substantially decrease computational cost with no loss in accuracy. Without the use of reduced order models, calculations of the LCO would be impractical. A wind tunnel model is tested to provide a quantitative experimental correlation with the theoretical results for the LCO response itself.

DTIC

*Oscillations; Aeroelasticity; Aerodynamic Characteristics; Wind Tunnel Tests; Delta Wings*

19990053582 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia  
Flow Visualisation about the Helicopter Deck of the Hydrographic Ship

Edwards, Craig D.; Defence Science and Technology Organisation, Australia; March 1999; In English; Original contains color illustrations

Report No.(s): DSTO-TR-0762; AR-010-842; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia); Hardcopy, Microfiche

Flow visualisation tests were performed about the helicopter deck of a 1/35 scale model of the Hydrographic Ship in the Low Speed Wind Tunnel at the Aeronautical and Maritime Research Laboratory. The model was tested over a range of relative wind angles using tuft, smoke and surface flow visualisation techniques to determine regions of adverse airflow that may have a detrimental effect on helicopter-ship operations in order to meet certification requirements. In particular, turbulent flow in the vicinity of the flight deck, vertical replenishment area and the ship's anemometer installation were identified, photographed and recorded on video. Effects of two fixed ship roll angles on the flow were also investigated. This document contains extensive results for all model configurations tested and describes in detail the flow features observed.

Author

*Flow Visualization; Performance Tests; Turbulent Flow; Scale Models; Hydrography; Helicopters; Air Flow*

19990053900 Department of the Navy, Washington, DC USA

Articulated Fin

Nedderman, William H., Jr., Inventor; Nov. 24, 1998; 6p; In English; Supersedes US-Patent-Appl-SN-668605, AD-D018073.

Patent Info.: Filed 3 Jun. 96.; US-Patent-Appl-SN-668,605; US-Patent-5,839,700

Report No.(s): AD-D019325; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)); Microfiche

An articulated fin of the present invention includes a nose section, a tail section, an upper flexible control surface, and a lower flexible control surface. The upper and lower flexible control surfaces each span from the tail section to the nose section. The fin further includes a gear assembly for applying compressive and tensile forces on the upper and lower flexible control surfaces. The gear assembly bends the tail section upwardly upon applying a tensile force on the upper flexible control surface and a compression

force on the lower flexible control surface, and bends the tail section downwardly upon applying a compression force on the upper flexible control surface and a tensile force on the lower flexible control surface.

DTIC

*Aerodynamic Characteristics; Fins; Compressibility*

19990059662 Arizona State Univ., Dept. of Mechanical and Aerospace Engineering, Tempe, AZ USA

Stability and Transition of Hypersonic Boundary-Layer Flows. *Final Report, 1 Feb. - 30 Sep. 1998*

Reed, Helen L.; Dec. 1998; 13p; In English

Contract(s)/Grant(s): F49620-98-1-0205

Report No.(s): AD-A359497; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Transition location can be a significant source of uncertainty in high-speed vehicle drag and heating predictions. Also, the efficacy of transition control depends largely on where transition is predicted. Because of facility noise, transition measurements in ground-test facilities are generally not reliable predictors of flight performance and we must rely on computational approaches for design for flight. The program at Arizona State University to investigate stability and transition of hypersonic boundary-layer flows has been ongoing for several years. In this final report we compile the significant theoretical and computational results from this program. The research has progressed through several logical steps with increasing complexity: Linear stability theory with the effects of chemistry and bow shock on a sharp circular cone at zero incidence with a PNS basic state. Examine 3-D effects on a sharp elliptic cone at zero incidence with a PNS basic state. Include nose bluntness (entropy layer and curved shock) plus nonequilibrium chemistry on a circular cone in the nonlinear Stability Equations with a Navier-Stokes basic state. Provide a new crossflow Reynolds number including compressibility and wall-temperature effects for use in conceptual design.

DTIC

*Conical Bodies; Hypersonic Vehicles; Boundary Layer Flow; Hypersonic Flow; Nonequilibrium Flow; Blunt Bodies; Cross Flow; Boundary Layer Transition; Navier-Stokes Equation; Noise Measurement; Slender Cones; Transition Flow*

19990060924 Technical Univ. of Budapest, Hungary

Periodica Polytechnica, Civil Engineering, Volume 42, No. 2, 1998

Wentl, F.; Tarjan-Fabry, M.; 1998; 13p; In English

Report No.(s): PB99-120313; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Contents include the following: Bending Theory of Shallow Shells Under Forced Deformation on their Edges; Transfer of Prestressing Force in Fiber Reinforced Concrete; Transmission Length Based on Measured Draw-in and Concrete Strains; Practical Design of Reinforced Concrete Columns; The Boundary Conditions of the Stress Functions of Triangular Polyhedron Grids Fitting Paraboloid Surfaces; Study on Simply Supported, Prismatic Folded Plate Structures by an Analytical Deducted Strip Method; Approximate Analysis of Tall Building Structures for Earthquake Using the Timoshenko-beam; On the Statistical Problems for Determination of the Shape of Prestressed Tents; The Influence of Pylons and Cable-stays on Aerodynamic Damping; and High-performance Concrete with Calcium Nitrite as Corrosion Protection.

NTIS

*Boundary Conditions; Composite Materials; Deformation; Fiber Composites; Parabolic Bodies; Stress Functions; Structural Analysis; Structural Engineering*

### 03

## AIR TRANSPORTATION AND SAFETY

*Includes passenger and cargo air transport operations; and aircraft accidents.*

19990054051 NASA Glenn Research Center, Cleveland, OH USA

Detecting the Onset of Fire in an Aircraft by Employing Correlation Spectroscopy

Goswami, Kisholoy, Intelligent Optical Systems, Inc., USA; Saxena, Indu, Intelligent Optical Systems, Inc., USA; Egalon, Claudio, Intelligent Optical Systems, Inc., USA; Mendoza, Edgar, Intelligent Optical Systems, Inc., USA; Lieberman, Robert, Intelligent Optical Systems, Inc., USA; Piltch, Nancy D., NASA Glenn Research Center, USA; Fifth International Microgravity Combustion Workshop; May 1999, pp. 376-377; In English; See also 19990053965

Contract(s)/Grant(s): NAS3-99030; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The cause of aircraft fire and locations of the fires are numerous. Worldwide, numerous in-flight fires have been passenger initiated, the prime location being the lavatory areas. Most in-flight fires in commercial carriers are of electrical origin and cigarettes. A cargo bay fire can be caused by a variety of reasons. The sheer number of different types of cargo makes it difficult



to identify the origin, especially when the fire reaches the catastrophic level. The damage can be minimized, and fire can be suppressed effectively if a warning system for the onset of fire is available for onboard monitoring.

Derived from text

*Aircraft Safety; Warning Systems; Combustion Products; Correlation Detection*

199900054193 Federal Aviation Administration, Washington, DC USA

Notices to Airmen Domestic/International, February 25, 1999

Dec. 31, 1999; 230p; In English

Report No.(s): PB99-137150; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

Topic discussed include the following: Airway Notams; Airports, Facilities and Procedural Notams; General FDC Notams; Part 95 Revisions to Minimum en Route IFR Altitudes and Changeover Points; International Notices to Airmen; and Graphic Notices.

NTIS

*Air Navigation; Runways; Airports; Navigation Aids; Flight Paths*

199900054448 Bureau of Transportation Statistics, Office of Airline Information, Washington, DC USA

Air Carrier Reporting Punctuality Assessment, Accounting and Reporting Directive

Feb. 25, 1999; 14p; In English

Report No.(s): PB99-144172; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Office of Airline Information reissues its 'Air Carrier Reporting Punctuality Assessment' report. The report was originally issued on January 26, 1999. The report covered the period from July 1, 1998, through December 31, 1998. The original report misstated the days late for several air carriers. This revised report contains seven tables showing the timeliness factor for each air carrier's recurrent reporting.

NTIS

*Air Transportation; Airline Operations*

199900056586 Federal Aviation Administration, Office of Aviation Medicine, Washington, DC USA

A Survey of Pilots on the Dissemination of Safety Information

Rakovan, Lori, Ohio State Univ., USA; Wiggins, M. W., University of Western Sydney, Australia; Jensen, R. S., Ohio State Univ., USA; Hunter, D. R., Federal Aviation Administration, USA; March 1999; 74p; In English

Report No.(s): DOT/FAA/AM-99/7; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A survey was conducted to obtain information from the pilot population on perceptions of safety-related training currently being offered, its usefulness, and the process through which it might be better disseminated to the general aviation population. The questionnaire assessed use of safety information, safety awareness, computer/video use, pilot self-assessment of proficiency, demographic information, and stressful experiences. In addition, four open-ended questions were included to allow pilots to freely express themselves on a variety of safety issues. The questionnaire was sent to 6,000 pilots (approximately 2,000 each to private, commercial, and airline transport) selected randomly from the pilot population. Responses were received from 1,822 (30.4% of the sample). Of the respondents, 31.3% were private pilots, 34.2% were commercial pilots, and 34.5% were airline transport pilots. The frequency of response to all questionnaire items for the three certificate categories are provided, plus analyses of the responses of pilots in a target group consisting of all private pilots and those commercial pilots who had not flown for hire. Analyses also compared the responses of (1) seminar attendees versus non-attendees, and (2) pilots who had been in accidents versus those who had not. Recommendations to improve the attendance of pilots at FAA-sponsored safety seminars are given.

Author

*Safety; Training Aircraft; Education; Airline Operations*

199900058168 National Transportation Safety Board, Washington, DC USA

National Transportation Safety Board Transportation Initial Decisions and Orders and Board Opinions and Orders Adopted and Issued during the Month of January 1999

Jan. 1999; 94p

Report No.(s): PB99-916701; NTSB/IDBOO-99/01; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This publication contains all Judge Initial Decisions and Board Opinions and Orders in Safety and Seaman Enforcement Cases for January 1999.

NTIS

*Air Transportation; Safety Management*

19990058437 Texas A&M Univ., Texas Transportation Inst., College Station, TX USA

Development and Application of Criteria for Optimization of the Texas Airport System, Sep. 1997 - Aug. 1998

Borowiec, J. D.; Dresser, G. B.; Nov. 1998; 102p; In English

Report No.(s): PB99-137754; No Copyright; Avail: CASI; A06; Hardcopy; A02; Microfiche

This project defines an 'ideal' system of general aviation airports that meets the future air transportation needs of the state. Beginning with a 'clean slate', so to speak, the ideal airport system is identified using methodology similar to the methodology used to develop the initial version of the Texas Highway Trunk System. Other criteria is also used. This project examines the question of airport system plan optimization, or rationalization, in a comprehensive context to include such factors as public policy considerations, air transportation as a mode of transportation, community economic vitality and competitiveness, traditional airport system criteria, and access to the system.

NTIS

Airports; Transportation; Planning

19990058456 Quadrant Engineering, Inc., Amherst, MA USA

Evaluation of Technologies for the Design of a Prototype In-Flight Remote Aircraft Icing Potential Detection System *Final Report*

Mead, J. B.; Pazmany, A.; Goodberlet, M.; Dec. 1998; 90p; In English

Report No.(s): PB99-130262; No Copyright; Avail: CASI; A05; Hardcopy; A01; Microfiche

This document presents the results of an investigation of remote sensing technologies applicable to the problem of remote aircraft icing potential detection. The long-term goal is to develop an aircraft mounted sensor capable of detecting dangerous levels of supercooled liquid water tens of kilometers ahead of the aircraft. Instruments capable of mapping range profiles of cloud liquid water content and mean particle size were investigated, specifically multifrequency radar and lidar (light detection and ranging). Multifrequency radar proved to be the most promising method for detecting liquid water content and parameters related to particle size. Backscattered power measurements at one, two, and three frequencies were input to a neural network trained to estimate liquid water content and two sizing parameters. This investigation showed that both two- and three-frequency radars were able to extract liquid water content and particle size parameters for various trial distributions of clouds and precipitation. Accuracy was highest for the three-frequency algorithm, especially in the estimation of liquid water content. Instruments capable of providing horizontal profiles of air temperature were also investigated, because they potentially provide a means of detecting regions of warmer air, free of supercooled drops.

NTIS

Aircraft Icing; In-Flight Monitoring; Ice Formation; Radar Detection; Remote Sensing

19990058486 Huntington Research and Engineering, San Jose, CA USA

Halon Replacement for Aircraft Fire Suppression Systems *Final Report, 1 Aug. 1995 - 1 Feb. 1998*

Haaland, Peter C.; Huntington, John; Jun. 1998; 55p; In English

Contract(s)/Grant(s): F33615-95-C-5045; AF Proj. 3005

Report No.(s): AD-A363631; FR-4021; AFRL-ML-WP-TR-1998-4120; No Copyright; Avail: CASI; A04; Hardcopy; A01; Microfiche

The objective of this program was to demonstrate the effectiveness and to determine the toxicity and associated risks of labile bromine compounds as halon replacements for suppression of engine nacelle and dry-bay fires in military aircraft. Tests performed during this program have shown that labile bromine compounds generally and phosphorous tribromide (PBr<sub>3</sub>) in particular, are more effective than Halon 1301 for both engine nacelle and dry-bay fire extinguishment and have neither ozone depletion nor global warming potentials. Theoretical electronic structure calculations and experimental chemical kinetics investigations were performed to enhance the understanding of the chemical action of PBr<sub>3</sub> fire suppression. Independent toxicity studies supervised by the tri-services toxicology laboratory (AL/OET) at Wright Patterson Air Force Base, determined that PBr<sub>3</sub> was neither mutagenic nor toxic to aquatic organisms. Additional data on the toxicological properties of PBr<sub>3</sub> were acquired by AL/OET including dermal irritation and acute and subchronic inhalation toxicity. These results formed the basis of their independent risk assessment, which concludes that use of PBr<sub>3</sub> as a halon replacement is safe in normally unoccupied spaces such as engine nacelles or dry-bays.

DTIC

Aircraft Safety; Global Warming; Fires

19990058598 Southampton Univ., Dept. of Aeronautics and Astronautics, UK

An Airborne Windshear Detection System

McLean, D., Southampton Univ., UK; Zouaoui, Z., Queensland Univ. of Technology, Australia; The Aeronautical Journal; December 1997; Volume 101, No. 1010, pp. 447-456; In English; See also 19990058597

Report No.(s): Paper-2102; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

For a long time there has been growing awareness in the international aviation community of the considerable danger which an encounter with the atmospheric phenomenon of windshear can bring to an aircraft in flight. Considerable statistical evidence is now available which points to the fact that aircraft windshear encounters in initial climb, final approach, or landing are extremely hazardous, often leading to fatal accidents. The paper presents details of a preliminary design for an airborne windshear detection system suitable for use in general aviation aircraft. First, an elementary explanation of windshear, and its most dangerous form, the microburst, is given, together with a short account of the hazards that such atmospheric phenomena can present to aircraft in flight, particularly at takeoff and landing. Then a novel windshear detection algorithm is described and associated simulation results are presented. The algorithm is based upon observer theory and uses only a restricted number of measurements. The system is shown to provide very good estimates of the horizontal and vertical components of some windshear encounters. These estimates of the windshear components are then used to provide the pilot with a warning of the presence of windshear together with an indication of its severity. Digital simulation has been used to show the effectiveness of the proposed design.

Author

*Wind Shear; Detection; Algorithms; Aerial Reconnaissance*

19990058599 International Civil Aviation Organization, Montreal, Quebec Canada

International Obligations as Regards Safety in International Civil Aviation

Abeyratne, R. I. R., International Civil Aviation Organization, Canada; The Aeronautical Journal; December 1997; Volume 101, No. 1010, pp. 457-466; In English; See also 19990058597

Report No.(s): Paper-2360; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In 1995, 19 western built jet aircraft were totally destroyed in air crashes which killed 383 passengers and 39 crew members. Although this rate of loss has been steady for the past 10 years, there were three major losses in 1996-the famous ValuJet and TWA aircraft in the USA and the world's worst midair collision in history New Delhi, India, where a Saudia Boeing 747 with 312 persons aboard collided with a Kazak aircraft carrying 37 passengers and crew. All on board were killed. At the time this article was being written, the Council of the International Civil Aviation Organization (Icao) had decided to convene in Montreal, from 10 to 12 November 1999, an international conference for Directors General of Civil Aviation to review the Icao Safety Oversight Programme and to consider its expansion. Almost simultaneous with this decision, Icao released its preliminary accident and security statistics for 1996, which reflect that scheduled air carriers from the 185 Icao Contracting States reported 23 fatal aircraft accidents in 1996, compared with 26 in the previous year. Although the incident rate declined in 1996, the number of passenger deaths reported rose dramatically in 1996 to 1135, compared with 710 in 1995. Safety is the primary concern of the world aviation community at the present time. It is not only because the fundamental postulates of the Chicago Convention of 1944 (Convention on International Civil Aviation, signed at Chicago on 7 December 1944.) call for the safe and orderly development of international civil aviation and mandate Icao to insure the safe and orderly growth of international civil aviation throughout the world but also because the aviation world faces a critical era.

Derived from text

*Security; Safety; Midair Collisions; Jet Aircraft; Conferences; Civil Aviation; Aircraft Accidents*

19990058597 Federal Aviation Administration, Atlantic City, NJ USA

Project Plan for the Baseline Measurement of Checkpoint Effectiveness and Efficiency

Klock, B. A.; Forbes, J. L.; May 1999; 20p; In English

Report No.(s): PB99-149684; DOT/FAA/AR-99/43; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

A project plan for obtaining baseline measurements of operational effectiveness and efficiency of the Northwestern checkpoint at Detroit Wayne Metropolitan Airport is described. The project will consist of carefully structured observations of checkpoint tasks under operational conditions. The baseline report will provide information that can be used to evaluate changes in checkpoint design.

NTIS

*System Effectiveness; Airport Security; Project Planning*

19990061200 Rannoch Corp., Alexandria, VA USA

NASA Low Visibility Landing and Surface Operations (LVLASO) Atlanta Demonstration: Surveillance Systems Performance Analysis *Final Report*

Cassell, Rick, Rannoch Corp., USA; Evers, Carl, Rannoch Corp., USA; Hicok, Dan, Rannoch Corp., USA; Lee, Derrick, Rannoch Corp., USA; June 1999; 116p; In English

Contract(s)/Grant(s): NAS1-19214; RTI-26-81U-4903; RTOP 538-04-13-02

Report No.(s): NASA/CR-1999-209110; NAS 1.26:209110; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

NASA conducted a series of flight experiments at Hartsfield Atlanta International Airport as part of the Low Visibility Landing and Surface Operations (LVLASO) Program. LVLASO is one of the subelements of the NASA Terminal Area Productivity (TAP) Program, which is focused on providing technology and operating procedures for achieving clear-weather airport capacity in instrument-weather conditions, while also improving safety. LVLASO is investigating various technologies to be applied to airport surface operations, including advanced flight deck displays and surveillance systems. The purpose of this report is to document the performance of the surveillance systems tested as part of the LVLASO flight experiment. There were three surveillance sensors tested: primary radar using Airport Surface Detection Equipment (ASDE-3) and the Airport Movement Area Safety System (AMASS), Multilateration using the Airport Surface Target Identification System (ATIDS), and Automatic Dependent Surveillance - Broadcast (ADS-B) operating at 1090 MHz. The performance was compared to the draft requirements of the ICAO Advanced Surface Movement Guidance and Control System (A-SMGCS). Performance parameters evaluated included coverage, position accuracy, and update rate. Each of the sensors was evaluated as a stand alone surveillance system.

Author

*Airport Surface Detection Equipment; Low Visibility; Surveillance; Flight Tests; Performance Tests; Systems Analysis; Requirements; Aircraft Specifications; Airfield Surface Movements; Aircraft Landing; Surveillance Radar*

19990061202 Rannoch Corp., Alexandria, VA USA

Development of Airport Surface Required Navigation Performance (RNP) *Final Report*

Cassell, Rick, Rannoch Corp., USA; Smith, Alex, Rannoch Corp., USA; Hicok, Dan, Rannoch Corp., USA; June 1999; 72p; In English

Contract(s)/Grant(s): NAS1-19214; RTI-26-81U-4903; RTOP 535-04-13-02

Report No.(s): NASA/CR-1999-209109; NAS 1.26:209109; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The U.S. and international aviation communities have adopted the Required Navigation Performance (RNP) process for defining aircraft performance when operating the en-route, approach and landing phases of flight. RNP consists primarily of the following key parameters - accuracy, integrity, continuity, and availability. The processes and analytical techniques employed to define en-route, approach and landing RNP have been applied in the development of RNP for the airport surface. To validate the proposed RNP requirements several methods were used. Operational and flight demonstration data were analyzed for conformance with proposed requirements, as were several aircraft flight simulation studies. The pilot failure risk component was analyzed through several hypothetical scenarios. Additional simulator studies are recommended to better quantify crew reactions to failures as well as additional simulator and field testing to validate achieved accuracy performance. This research was performed in support of the NASA Low Visibility Landing and Surface Operations Programs.

Author

*Aircraft Performance; Risk; Airfield Surface Movements; Air Navigation; Taxiing; Approach; Aircraft Specifications; Flight Characteristics*

19990061221 Federal Aviation Administration, Flight Safety Research Section, Atlantic City, NJ USA

Snow and Ice Particle Sizes and Mass Concentrations at Altitudes up to 9 km (30,000 ft) *Final Report*

Jeck, R. K., Federal Aviation Administration, USA; Aug. 1998; 102p; In English

Report No.(s): PB99-126922; DOT/FAA/AR-97/06; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

About 7600 nautical miles (nm) (14,000 km) of select ice particle measurements over the USA have been compiled into a single, computerized database for use in characterizing ice crystal and snowflake (generally termed ice particle) size distributions and mass concentrations at flight altitudes. Data are from 50 research flights by six agencies in eight flight research projects using Particle Measuring Systems' one-dimensional (1-D) and two-dimensional (2-D) particle sizing probes. Primary recorded variables convenient distances in wintertime clouds, snowstorms, cirrus, and other high-altitude clouds. The findings are that, generally, the largest particles and the greatest concentrations of total ice particle mass (TIPM) are confined to altitudes below 20,000 ft (6 km). Anvil clouds and stratiform clouds associated with warm season mesoscale convective systems have provided some of the largest TIPM's, the greatest particle concentrations, and the largest particle sizes at high and mid altitudes, respectively. In contrast to supercooled cloud droplets where the largest liquid water (mass) concentrations are confined to short



distances of 3 nm or less in convective clouds, the largest average TIPM's in glaciated clouds have been found in layer clouds over distances up to 30 nm. Based on these analyses, a summary table of ice/snow cloud characteristics is proposed for use as engineering specifications for aviation purposes.

NTIS

*Ice Formation; Snow; Crystals; Aircraft Icing; Mesoscale Phenomena; Particle Mass*

19990061222 Bureau of Transportation Statistics, Office of Airline Information, Washington, DC USA

Airport Activity Statistics of Certificated Air Carriers: Summary Tables, Period ending 31 Dec. 1997

1998; 32p; In English

Report No.(s): PB99-126914; No Copyright; Avail: CASI; A03; Hardcopy; A01; Microfiche

Airport Activity Statistics of Certificated Air Carriers: Summary Tables presents summary data for all scheduled and nonscheduled service by large certified U.S. air carriers—including the volume of passenger, freight, and mail enplanements, and aircraft departures for each airport served during the 12 months ending December 31, 1997.

NTIS

*Air Transportation; Airports; Statistical Analysis*

19990061229 National Transportation Safety Board, Office of Judges, Washington, DC USA

National Transportation Safety Board. Transportation Initial Decisions and Orders and Board Opinions and Orders: Adopted and Issued during the Month of October 1998

Oct. 1998; 165p; In English

Report No.(s): PB98-916710; NTSB/IDBOO-98/10; No Copyright; Avail: CASI; A08; Hardcopy; A02; Microfiche

This publication contains all Judge Initial Decisions and Board Opinions and Orders in Safety Enforcement and Seaman Enforcement Cases for October 1998.

NTIS

*Safety Management; Accident Prevention; Aircraft Accidents*

19990061230 National Transportation Safety Board, Washington, DC USA

National Transportation Safety Board Aircraft Accident Report: In-Flight Icing Encounter and Uncontrolled Collision with Terrain, COMAIR Flight 3272, Embraer EMB-120RT, N265CA, Monroe, Michigan, January 9, 1997

Nov. 04, 1998; 362p; In English

Report No.(s): PB98-910404; NTSB/AAR-98/04; No Copyright; Avail: CASI; A16; Hardcopy; A03; Microfiche

The report explains the accident involving an EMB-120RT, operated by COMAIR Airlines, Inc., as flight 3272, that crashed during a rapid descent after an uncommanded roll excursion near Monroe, Michigan, on January 9, 1997. Safety issues in the report focused on procedures for the use of ice protection systems, airspeed and flap configuration information, stall warning/protection system capabilities, operation of the autopilot in icing conditions, aircraft icing certification requirements, and icing-related research.

NTIS

*Aircraft Accidents; Aircraft Icing; Accident Investigation; Ice Formation; Ice Prevention*

19990061539 National Transportation Safety Board, Washington, DC USA

Annual Review of Aircraft Accident Data, U.S. Air Carrier Operations, Calendar Year 1995

Aug. 31, 1998; 80p; In English

Report No.(s): PB98-169147; NTSB/ARC-98/01; No Copyright; Avail: CASI; A05; Hardcopy; A01; Microfiche

This publication presents the record of aviation accidents involving revenue operations of U.S. Air Carriers including Commuter Air Carriers and On Demand Air Taxis for calendar year 1995. The report is divided into three major sections according to the federal regulations under which the flight was conducted - 14 CFR 121, Scheduled 14 CFR 135, or Nonscheduled 14 CFR 135. In each section of the report tables are presented to describe the losses and characteristics of 1995 accidents to enable comparison with prior years.

NTIS

*Air Transportation; General Aviation Aircraft; Aircraft Accidents; Regulations*

19990061512 National Transportation Safety Board, Washington, DC USA

National Transportation Safety Board Transportation Initial Decisions and Orders and Board Opinions and Orders Adopted and Issued during the Month of March 1999

Mar. 1999; 196p

Report No.(s): PB99-916703; NTSB/IDBOO-99/03; No Copyright; Avail: CASI; A00; Hardcopy; A03; Microfiche

This publication contains all Judges Initial Decisions and Board Opinions and Orders in Safety and Seaman Enforcement Cases March 1999

NTIS

*Air Transportation; Safety Management; Transportation*

## 04

### AIRCRAFT COMMUNICATIONS AND NAVIGATION

*Includes digital and voice communication with aircraft, air navigation systems (satellite and ground based), and air traffic control.*

19990053728 Naval Surface Warfare Center, Dahlgren Div., Dahlgren, VA USA

An Evaluation of Precise Absolute Navigation (PAN) Performance Under Dynamic Conditions *Final Report*

Hermann, Bruce R.; Jan. 1999; 39p; In English

Report No.(s): AD-A362733; NSWCDD/TR-98/113; No Copyright; Avail: CASI; A03; Hardcopy; A01; Microfiche

This report describes a method where the Global Positioning System (GPS) Precise Positioning Service (PPS) solutions recorded in the field can be reprocessed at a later time with the precise ephemerides, without requiring that the observations be saved. The reprocessing with the precise ephemerides improves the quality of the navigation solutions compared with the solutions obtained when the real-time broadcast ephemerides are used. This report continues the investigation of the Precise Absolute Navigation (PAN) technique by exploring its accuracy under two particular conditions. The first condition is operation with single-frequency observations and use of the broadcast ionospheric model, the second is when the user experiences appreciable height variations due to his motion, as in an aircraft. Also demonstrated are the accuracy of PAN solutions to simulated observations from a high-altitude, low-speed platform, such as an Unmanned Aerial Vehicle (UAV).

DTIC

*Air Navigation; Global Positioning System; Atmospheric Models; Earth Ionosphere; Navigation*

19990058483 Federal Aviation Administration, Technical Center, Atlantic City, NJ USA

ARTS IIIA Terminal Baseline Research Report

Mogford, Richard H.; Allendoerfer, Kenneth R.; Galushka, Joseph; Apr. 1999; 85p; In English

Report No.(s): AD-A363589; DOT/FAA/CT-TN99/7; No Copyright; Avail: CASI; A05; Hardcopy; A01; Microfiche

This report provides baseline measurements on the Automated Radar Terminal System (ARTS) IIIA. Researchers developed a set of measurements useful for evaluating the efficiency and effectiveness of terminal air traffic control automation systems. These measurements followed six high-level operational constructs: Safety, Capacity, Performance, Workload, Usability, and Simulation Fidelity. To collect these measurements for the ARTS IIIA, we conducted an air traffic control simulation using four sectors of Boston Terminal Radar Approach Control (TRACON) airspace with a traffic volume representing a 90th percentile day. Twelve controllers from Boston TRACON served as participants in the 3-week study. Recordings from the Target Generation Facility and Continuous Data Recording (CDR) systems provided objective data for measures such as the average number of aircraft controlled and the average number of data entries. Questionnaires and expert observer rating forms provided subjective data for measures such as the average controller workload and controller performance. This report provides statistics at several levels of specificity: aggregated across all sectors and runway configurations, by individual sector and runway configuration, and by 15-min intervals. Data from the study are intended to provide a meaningful representation of the TRACON controller position. We provide guidance on using these baseline measurements to examine the effectiveness and efficiency of future terminal automation systems. This guidance includes recommendations for merging quantitative statistics with controller opinion. We also include recommendations regarding the appropriate and inappropriate use of these data.

DTIC

*Automated Radar Terminal System; Automatic Control; Air Traffic Control*

19990059740 National Inst. of Standards and Technology, Time and Frequency Div., Boulder, CO USA

Global Positioning System Receivers and Relativity

Ashby, N.; Weiss, M.; Mar. 1999; 56p; In English



Report No. (a): PB99-151615, NIST/TN-1385, No Copyright, Avail: CASI, A01, Microfiche, A04, Hardcopy

The authors illustrate the general methods for applying relativistic corrections needed by a Global Positioning System (GPS) receiver in providing time or position to a user. The authors need focus on estimating the geometric range delay, the time GPS signals require to propagate from the transmitter to the receiver in vacuum. The authors discuss several common uses of GPS including time tagging at the receiver, time tagging at the transmitter, and earth-fixed timing receivers. The authors include examples which illustrate these cases numerically.

NTIS

*Global Positioning System; Receivers; Relativity*

## 05

### AIRCRAFT DESIGN, TESTING AND PERFORMANCE

*Includes aircraft simulation technology*

19990053504 Goodrich (B. F.) Aerospace, Simulation and Algorithm Development Center, Bedford, MA USA

Integrated Mechanical Diagnostics (IMD) Health Usage and Management System (HUMS)

Gill, John, Goodrich (B. F.) Aerospace, USA; Workshop on Helicopter Health and Usage Monitoring Systems, February 1999, pp. 7-15; In English; See also 19990053503; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P.O. Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

The USA Navy and USA Marines, in partnership with BFGoodrich Aerospace, have embarked upon an ambitious program to improve operational readiness and flight safety while slashing maintenance-related costs. That HUMS program is now on the cusp of an important milestone - installation of the first fully functional system on two aircraft types, the SH-60B support helicopter and the CH-53E cargo helicopter. The system has evolved under Joint Dual-Use Program Office's (JDUPO) Commercial Operations and Support Savings Initiative (COSSI) and is now referred to as IMD-HUMS. This paper presents the system's current state of evolution and outlines how the system will continue to evolve as we strive to achieve fleet-wide deployment. This paper will describe the components and processes that make up the fully functional and integrated system. It will also outline the near term implementation plan to prepare for eventual transition from initial installation to fleet-wide deployment.

Derived from text

*Flight Safety; Maintainability; Installing; Helicopters; Diagnostics*

19990053505 Helitune Ltd., Malvern, UK

Modular Distributed HUMS: An Overview

Mowbray, Keith, Helitune Ltd., UK; Workshop on Helicopter Health and Usage Monitoring Systems, February 1999, pp. 17-22; In English; See also 19990053503; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P.O. Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

Contents include the following: Defining the system; HUMS requirements; The common modules; Availability; On board laser tracker; Basic system configuration; All up system configuration; Distributed modular HUMS; Engine HUMS functions; and Transmission HUMS functions.

CASI

*Management Systems; Electronic Modules; Availability; Performance Prediction*

19990053506 Smiths Industries, Inc., Grand Rapids, MI USA

UK Ministry of Defence Health and Usage Monitoring System (HUMS)

Trammel, Charles, Smiths Industries, Inc., USA; Vossler, Gerald, Smiths Industries, Inc., USA; Workshop on Helicopter Health and Usage Monitoring Systems, February 1999, pp. 23-41; In English; See also 19990053503; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P.O. Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

The Health and Usage Monitoring System (HUMS) have been designed with building block approach to allow easy configuration for: Cockpit Voice and Flight Data Recorder (CVFDR) operation; Usage and exceedance monitoring; Rotor Track and Balance (RTB); Airframe Vibration Monitoring (AVM); Transmission Vibration Monitoring (TVM); and Engine Vibration Monitoring (EVM). The UK HUMS Chinook Program will: Tailor and qualify airborne and ground systems, and Provide an Aircraft Design Authority (ADA) approved installation design.

Derived from text

*Monitors; Aerodynamic Balance; Aircraft Design; Flight Recorders; Health*

19990053507 Chadwick-Helmuth Co., Inc., El Monte, CA USA

Health Monitoring of Helicopters: Applications and Achievements

Dohrn, Lawrence L., Chadwick-Helmuth Co., Inc., USA; Workshop on Helicopter Health and Usage Monitoring Systems; February 1999, pp. 43-48; In English; See also 19990053503; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P.O. Box 4331, Melbourne, Victoria 3001, Australia); Hardcopy, Microfiche

History has taught us that the growth of helicopter health monitoring has been more evolutionary than revolutionary. Only the most sophisticated of helicopter operators whether it be military or commercial invests in the manpower and training to incorporate some of the software tools made available by "HUMS" suppliers. Developmental offerings of prospective products and claims of dramatic benefits are in most instances unrealized. As events unfold, we are seeing that permanent on-board monitoring of basic helicopter functions are nevertheless yielding significant benefits, largely from availability of continuous recorded data for both immediate light line usage and also for post flight analysis. The most fundamental of monitoring functions; that of rotor track and balance is yielding important information regarding not only the rotor system but that of associated components. The extension of rotor track and balance basics yields important clues as to how carefully applied diagnostics to other rotating components can similarly benefit from the more intensive examination of newly available data. This paper will present some of the findings that are now possible and the conclusions as to how expansion of basics can lead to a more powerful operational utility of health monitoring tools.

Derived from text

*Aerodynamic Balance; Health; Helicopters; Postflight Analysis; Rotary Wings*

19990053508 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia  
Vibration Monitoring of Royal Australian Navy Helicopters

Blunt, David, Defence Science and Technology Organisation, Australia; O'Neill, Peter, Royal Australian Navy, Australia; Rebbelch, Brian, Defence Science and Technology Organisation, Australia; Workshop on Helicopter Health and Usage Monitoring Systems; February 1999, pp. 49-56; In English; See also 19990053503; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P.O. Box 4331, Melbourne, Victoria 3001, Australia); Hardcopy, Microfiche

This paper provides a brief background of helicopter vibration monitoring in the , and describes the integrated vibration monitoring system currently being introduced into their fleet of S-70B-2 Seahawk and SH-60 Sea King helicopters. The system incorporates standard commercial airframe rotor track and balance equipment, and an AMRL - developed transmission vibration monitoring system. Both incorporate permanently mounted sensors wired to cabin receptacles, and carry-on / carry-off vibration analysers.

Author

*Vibration; Monitors; SH-60 Helicopter; Aerodynamic Balance*

19990053511 Vibro-Meter S.A., Fribourg, Switzerland

ROTABS(trademark): Re-Writing the Manual on Rotor Track and Balance

Cant, Robert, Vibro-Meter S.A., Switzerland; Workshop on Helicopter Health and Usage Monitoring Systems; February 1999, pp. 89-98; In English; See also 19990053503; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P.O. Box 4331, Melbourne, Victoria 3001, Australia); Hardcopy, Microfiche

ROTABS(TM) is an integral part of the eurocopter aircraft recording and monitoring system EUROARMS. It is more comprehensive system. It has superior balance result. Also simplified /safer operation and has high reliability stand - alone or integrated system.

CASI

*Monitors; Automatic Control; Military Helicopters*

19990053512 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia  
Helicopter Structural Usage Monitoring Work at DSTO Airframes and Engines Division

Lombardo, Domenico, Defence Science and Technology Organisation, Australia; Workshop on Helicopter Health and Usage Monitoring Systems; February 1999, pp. 137-151; In English; See also 19990053503; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P.O. Box 4331, Melbourne, Victoria 3001, Australia); Hardcopy, Microfiche

Pilot Questionnaire data used to create new usage spectrum for Australian Black Hawk. Quantitative program proposed for measuring Black Hawk usage. Usage monitoring research looking at economic effectiveness of usage monitoring - estimation

of gross Weight from indirect measurement, and application of AI techniques to examine problems of identifying flight conditions with minimal information.

CASI

*Airframes; Helicopters; Monitors; Engine Control*

19990053517 Aerostructures, Inc., Arlington, VA USA

Helicopter Usage Monitoring Using the MaxLife System

White, David, Aerostructures, Inc., USA; Workshop on Helicopter Health and Usage Monitoring Systems; February 1999, pp. 167-179; In English; See also 19990053503; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P.O. Box 4331, Melbourne, Victoria 3001, Australia); Hardcopy, Microfiche

Contents include the following: Overview of Aerostructures; Specialized Usage Monitoring Expertise; AH-1W Usage Monitoring Results; and MaxLife System and Programs.

CASI

*Monitors; AH-1W Helicopter; Life (Durability); Damage Assessment*

19990053526 Analysis, Management and Systems (Pty) Ltd., South Africa

Health and Usage Monitoring System for the Hawk Aircraft

Havinga, M. C., Analysis, Management and Systems (Pty) Ltd., South Africa; Botes, C. J., Analysis, Management and Systems (Pty) Ltd., South Africa; Workshop on Helicopter Health and Usage Monitoring Systems; February 1999, pp. 217-225; In English; See also 19990053503; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P.O. Box 4331, Melbourne, Victoria 3001, Australia); Hardcopy, Microfiche

This paper describes the Health and Usage Monitoring System for the Hawk aircraft supplied to the Royal Australian Air Force. British Aerospace MA&A placed a contract upon AMS for the development of a HUMS with the following functionality: (a) Avionics equipment health monitoring. (b) Flight data recording in crash protected memory. (c) Cockpit voice data recording in crash protected memory. (d) An airframe fatigue monitoring system. (e) Low cycle fatigue monitoring of the engine. Health Monitoring is conducted by the sampling and storage of avionics equipment built-in test data. When a failure occurs the relevant environmental data is stored which allows detailed analysis of failure conditions on the aircraft. In addition, failure discretes as asserted by the OBOGS are monitored and stored by the HUMS. Airframe Usage Monitoring is conducted by sampling and processing of strain gauges mounted at key locations within the aircraft. Engine Usage Monitoring is conducted by the sampling and processing of key engine parameters sampled from engine and aircraft sensors. The HUMS consists of a Data Acquisition Unit, a Crash Survivable Memory Unit, a Flightline System and a Desktop System. The Data Acquisition Unit samples, processes and stores data from sensors and aircraft equipment. It formats and transmits flight data to the Crash Survivable Memory Unit. All stored data is transmitted to the Flightline System during upload and download operations at the aircraft flightline. The Crash Survivable Memory Unit receives formatted flight data frames for the Data Acquisition Unit and samples voice data from the Cockpit Audio Management Unit and stores this data in crash protected memory.

Author

*Health; Aircraft Equipment; Airframes; Crashes; Data Acquisition; Failure*

19990053566 Dayton Univ. Research Inst., Research Inst., OH USA

Update of the Probability of Fracture (PROF) Computer Program For Aging Aircraft Risk Analysis, Volume 1, Modifications and User's Guide. *Final Report, Sep. 1996 - Nov. 1998*

Hovey, Peter W.; Berens, Alan P.; Loomis, John S.; Nov. 1998; 92p; In English

Contract(s)/Grant(s): F09603-95-D-0175; AF Proj. FAAF

Report No.(s): AD-A363010; UDR-TR-1998-00154-VOL-1; AFRL-VA-WP-TR-1999-3030; No Copyright; Avail: CASI; A05; Hardcopy; A01; Microfiche

The computer program, Probability of Fracture (PROF) was written to facilitate the Air Force implementation of structural risk analyses. The fracture probabilities from a PROF run directly complement the deterministic damage tolerance analyses that form the bases for structural maintenance actions. However, there are many structural scenarios that cannot be modeled directly by a single PROF run, but can be analyzed through the combination of multiple PROF runs. These include the scenarios introduced by widespread fatigue damage and corrosive thinning. While these more complex applications of PROF have been demonstrated, they were difficult to implement because of the post processing required of the individual PROF runs. Further, to accommodate the calculation of failure due to discrete source damage in the presence of widespread fatigue damage, a different failure criterion was needed. Therefore, PROF was updated to accommodate these calculations and to incorporate more robust computational

algorithms. This report describes the modifications made to PROF and serves as a users guide for the program. Volume 2 is a programmers guide to the PROF software.

DTIC

*Probability Theory; Risk; Structural Analysis; User Manuals (Computer Programs); Aging (Metallurgy); Cracking (Fracturing)*

19990053688 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne Australia  
Residual Stress Measurements and Boeing Wedge Durability Data for the Proposed 470 Bulkhead Bonded Repair  
Olson-Jacques, Christina; Nov. 1998; 32p; In English

Report No.(s): AD-A361706; DSTO-TN-0178; DODA-AR-010-675; No Copyright; Avail: CASI; A03; Hardcopy; A01; Microfiche

Fatigue cracking problems have occurred in the F/A-18 470.5 bulkhead during initial full scale testing. The surface of this bulkhead is shot-peened to introduce compressive residual stress to increase the fatigue life of the component as part of the manufacturing and maintenance program. The Aeronautical and Maritime Research Laboratory (AMRL) is investigating the effect of applying a composite patch to reduce the critical strains in the crotch area. Boeing wedge durability tests were used to define the most suitable metal preparation procedure to apply a durable patch to a shotpeened aluminium alloy surface. The x-ray diffraction technique was used to assess any reduction in the beneficial shot-peened residual stress after typical abrasion and heat treatment stages in the preparation procedure. It was found that the abrasion and heat treatment processes used to achieve the most durable surface treatment for bonding did not significantly reduce the beneficial compressive surface stresses induced by the shot-peening process.

DTIC

*Aircraft Maintenance; Bonded Joints; Bulkheads; Fatigue Life; Crack Propagation; Residual Stress; Adhesive Bonding; Metal Surfaces; Stress Measurement; Shot Peening*

19990053656 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

Unmanned Aerial Vehicle Mission Level Simulation

Walston, Jennifer G.; Mar. 1999; 73p; In English

Report No.(s): AD-A361707; AFIT/GOR/ENS/99M-17; No Copyright; Avail: CASI; A04; Hardcopy; A01; Microfiche

We develop an object-oriented simulation that models the surveillance and Active Suppression of Enemy Air Defense (SEAD) missions of the Unmanned Aerial Vehicle (UAV) RQ-1A Predator. The simulation, written in Java using the Silk simulation package, interfaces with a Reactive Tabu Search routing algorithm to provide optimal UAV routes. The routing algorithm is called by the simulation to account for changes in weather conditions and to provide a means of dynamically retasking the UAV. The simulation and analysis support a UAV Battlelab initiative to test the operational effects of proposed changes in Predator performance and UAV capability to perform in an Active SEAD mission. Analysis efforts examine the effect of speed, endurance, and weather susceptibility on UAV operational effectiveness and the effects of radar cross section, threat density, and threat lethality on UAV Active SEAD mission performance.

DTIC

*Pilotless Aircraft; Object-Oriented Programming; Computerized Simulation; Flight Simulation; Aerial Reconnaissance; Routes*

19990053657 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

Dynamic Unmanned Aerial Vehicle (UAV) Routing with a Java-Encoded Reactive Tabu Search Metaheuristic

ORourke, Kevin P.; Mar. 1999; 131p; In English

Report No.(s): AD-A361708; AFIT/GOA/ENS/99M-06; No Copyright; Avail: CASI; A07; Hardcopy; A02; Microfiche

In this paper we consider the dynamic routing of unmanned aerial vehicles (UAVs) currently in operational use with the US Air Force. Dynamic vehicle routing problems (VRP) have always been challenging, and the airborne version of the VRP adds dimensions and difficulties not present in typical ground-based applications. Previous UAV routing work has focused on primarily on static, pre-planned situations; however, scheduling military operations, which are often ad-hoc, drives the need for a dynamic route solver that can respond to rapidly evolving problem constraints. With these considerations in mind, we examine the use of a Java-encoded metaheuristic to solve these dynamic routing problems, explore its operation with several general problem classes, and look at the advantages it provides in sample UAV routing problems. The end routine provides routing information for a UAV virtual battlespace simulation and allows dynamic routing of operational missions.

DTIC

*Pilotless Aircraft; Heuristic Methods; Traveling Salesman Problem; Dynamic Programming; Object-Oriented Programming; Java (Programming Language); Routes; Flight Plans*



19990053664 Federal Aviation Administration, Airport and Aircraft Safety Research and Development Div., Atlantic City, NJ USA

Comparison of Boundary Correction Factor Solutions for Two Symmetric Cracks in a Straight-Shank Hole *Final Report*  
Bakuckas, J. G.; Apr. 1999; 30p; In English

Report No.(s): PB99-147399; DOT/FAA/AR-98/36; No Copyright; Avail: CASI; A03; Hardcopy; A01; Microfiche

This report compares the mode I boundary correction factor solutions for two symmetric elliptical cracks emanating from a straight-shank hole. A global-intermediate-local (GIL) hierarchical approach was developed using the finite element method (FEM). Comparisons were made with the following methods: the FEM with the equivalent domain integral, semiempirical boundary correction factor equations, the finite element alternating method, the boundary element method with the crack opening displacement approach, the boundary element method using special crack-tip elements, and the three-dimensional weight function method.

NTIS

*Boundary Element Method; Cracking (Fracturing); Correlation*

19990053793 APR Consultants, Inc., Medway, OH USA

A Practical Method for Aircraft Life Enhancement *Final Report*

May 1998; 26p; In English

Contract(s)/Grant(s): F33615-97-C-3214

Report No.(s): AD-A362642; STTR 97-142; No Copyright; Avail: CASI; A03; Hardcopy; A01; Microfiche

The purpose of this Phase I effort was to prove the feasibility of reducing dynamic loads induced into aircraft structure by increasing landing gear strut precharge pressure. Reducing dynamic loads will reduce fatigue damage to aircraft structure resulting in life extension and reduced maintenance and inspections. An additional purpose of this effort was to determine the "degree" of life enhancement that can be achieved. Finally, commercial aircraft operations and maintenance organizations were contacted to determine the level of ground loads related problems that occur in day to day operations. A NASA Langley instrumented A-6 main landing gear strut was used to experimentally validate the concept. Computer simulations were used to predict dynamic load reductions for a large matrix of conditions for a variety of aircraft. The computer predictions were used to assess the potential life enhancement that could be achieved. Questionnaires were sent to a variety of commercial airline organizations requesting information regarding maintenance, inspection and structural failure data that relate to this effort. Phase I of this effort proved conclusively (both analytically and experimentally) that ground loads can be reduced by 40% or more by increasing strut precharge pressure. Estimated improvements in life of up to 15% were calculated for a randomly selected structure. A "hot spot" would show much greater improvement. The results of Phase I were better than anticipated. The application of this technology will include military and civilian aircraft. The aircraft that will benefit the most will be large flexible aircraft such as commercial jets and military bomber and cargo aircraft that operate heavy and on rough runways.

DTIC

*Dynamic Loads; Aircraft Structures; Fatigue (Materials); Structural Failure; Struts*

19990054836 NASA, Washington, DC USA

Toward Mach 2: The Douglas D-558 Program

Hinley, J. D., Editor, NASA Dryden Flight Research Center, USA; 1999; 172p; In English

Report No.(s): NASA/SP-1999-4222; NAS 1.21-4222; ISBN 0-16-049962-3; No Copyright; Avail: CASI; A08; Hardcopy; A02; Microfiche

This monograph contains the edited transcript of a symposium marking the 50th anniversary of this aircraft's first flight in 1948. A sister aircraft to the more well-known rocket-powered X-1, the jet-powered D-558 gave NACA researchers many useful insights about the transonic speed range. Several of the original aircraft pilots present accounts of their involvement in the program. Appendices include design specifications for the Douglas D-558-1 and -2 as well as declassified documentation and memoranda (1949-1957) regarding the progress of the program.

Author

*D-558 Aircraft; Aircraft Design; Histories; Transonic Speed*

19990058201 British Aerospace Public Ltd. Co., Military Aircraft and Aerostructures, Warton, UK

Test and Evaluation in the New Millennium: A European Industrial Perspective

Lee, R. N., British Aerospace Public Ltd. Co., UK; Third Test and Evaluation International Aerospace Forum. The Management and Technology Trends of Ranges and Facilities into the 21st Century: Proceedings; 1998, pp. 4.1-4.7; In English; See also 19990058200; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK).



Hardcopy, Microfiche

The paper initially reviews the factors which have influenced the business since the 1980's and investigates the trends which have driven policy. It discusses the moves towards a smaller UK Industry with the advent of the growing affordability issue and some of the measures adopted in response. The review continues with an assessment of the current international scene and the impact that this is perceived to have on European Programmes and their associated Test and Evaluation. From this base, consideration is given to the future needs of testing within Europe, both in terms of test technology and test infrastructure. A number of issues are raised with regard to national facilities, their affordability and capability. The paper concludes with an assessment of these issues and proposes a number of challenges which need to be addressed to satisfy European Industry needs.

Author

*Performance Tests; Evaluation; Commerce*

19990058214 Defence Evaluation Research Agency, Airborne Instrumentation, Aberporth, UK

*Changing Requirements for Aerial Targets*

Buck, J. K., Defence Evaluation Research Agency, UK; Towning, J. N., Defence Evaluation Research Agency, UK; Third Test and Evaluation International Aerospace Forum, The Management and Technology Trends of Ranges and Facilities into the 21st Century, Proceedings, 1998, pp. 20.1-20.5, In English. See also 19990058200, Copyright: Avail: Issuing Activity, Hardcopy

With the increasing sophistication of new weapon systems the overriding requirement for aerial targets, is that they should be realistic: i.e. they should have the same signature, size, shape and performance of the threats that they are replicating. In many cases the only way all the above criteria can be met simultaneously is by effectively replicating the threat itself, for example the use of full scale drones. This approach although very thorough is rather expensive. If however only a limited number of target characteristics are required it becomes possible to use cheaper alternatives, such as enhanced sub scale drones and/or towed targets. The types of enhancement required include thermal and radar cross section augmentation. The signatures of the present generation of sub scale drones and towed targets, both IR and radar augmented versions, are unrepresentative of the threats that are now being considered by weapon system designers. This short coming is particularly prominent when weapons fitted with IR imaging seekers are being tested, because these targets have reduced spatial dimensions and, in the case of towed targets, consist of a single point source of radiation. The seeker could identify this small point as a decoy and ignore it, and start searching for another target, possibly finding the towing aircraft. A similar situation exists for weapons fitted with radar seekers, which may look for effects such as scintillation, glint and engine modulation rather than just the largest return. This paper describes the various augmentation techniques available and under development by Airborne Instrumentation, T&E Ranges Sector, DERA Aberporth, and WX3, Weapons Sector, DERA Fort Halstead, to enhance sub scale drone and towed targets in an attempt to provide realistic representations of typical threats.

Author

*Weapon Systems; Target Drone Aircraft; Scintillation; Homing Devices; Airborne Equipment*

19990059091 Intergraph Corp., Federal Systems Div., Huntsville, AL USA

USAF Logistics Process Optimization Study for the Aircraft Asset Sustainment Process, Volume 3, Future to be Asset Sustainment Process Model *Final Report*

Adamson, Anthony; Tribble, Dorothy J.; Dec. 31, 1998; 176p; In English

Report No.(s): AD-A363883; AFLMA-LM199731101-VOL-3; No Copyright; Avail: CASI; A09; Hardcopy; A02, Microfiche

This USAF Logistics Process Optimization Study for the Aircraft Asset Sustainment Process -- Phase II Report is the second in a series of technical reports prepared under AFLMA Project LM9731101. It is published as three separate volumes. Volume I, USAF Logistics Process Optimization Study for the Aircraft Asset Sustainment Process -- Phase II Report, discusses the result and cost/benefit analysis of testing three initiatives at Langley Air Force Base as possible solutions to several findings discussed in the Phase I Report, USAF Logistics Asset Sustainment As Is Process. Volume II, (To Be Models), contains the To-Be Retail Asset Sustainment Process Model displaying the activities and functions related to the improved processes for receipt, storage, issue and delivery of materiel as tested at Langley Air Force Base, Virginia Volume III, (Future Retail Aircraft Asset Sustainment Process Models,) is published as a stand-alone volume of this report. Volume III contains a discussion of the Reengineering Team's efforts in the development of a logistics process model for a more distant future asset sustainment scenario unconstrained by today's logistics information systems limitations. It also contains a process model reflecting the Reengineering Team's vision of the future asset sustainment process.

DTIC

*Logistics Management; Aircraft Models; Logistics; Cost Effectiveness*

19990039092 Intergraph Corp., Federal Systems Div., Huntsville, AL USA

USAF Logistics Process Optimization Study for the Aircraft Asset Sustainment Process, Volume 1 *Final Report*

Adamson, Anthony; Tribble, Dorothy J.; Dec. 31, 1998; 188p; In English; Prepared in collaboration with Intergraph Corp., Huntsville, AL. ADA363883 ADA363885

Report No.(s): AD-A363884; AFLMA-LM199731101; No Copyright; Avail: CASI; A09; Hardcopy; A02; Microfiche

This USAF Logistics Process Optimization Study for the Aircraft Asset Sustainment Process -- Phase II Report is the second in a series of technical reports prepared under AELMA Project LM9731101. It is published as three separate volumes. Volume I, USAF Logistics Process Optimization Study for the Aircraft Asset Sustainment Process -- Phase II Report, discusses the result and cost/benefit analysis of testing three initiatives at Langley Air Force Base as possible solutions to several findings discussed in the Phase I Report, USAF Logistics Asset Sustainment As Is Process, Volume II, (To Be Models), contains the To-Be Retail Asset Sustainment Process Model displaying the activities and functions related to the improved processes for receipt, storage, issue and delivery of materiel as tested at Langley Air Force Base, Virginia Volume III, (Future Retail Aircraft Asset Sustainment Process Models,) is published as a stand-alone volume of this report. Volume III contains a discussion of the Reengineering Team's efforts in the development of a logistics process model for a more distant future asset sustainment scenario unconstrained by today's logistics information systems limitations. It also contains a process model reflecting the Reengineering Team's vision of the future asset sustainment process.

DTIC

*Aircraft; Logistics; Cost Effectiveness; Aircraft Models*

19990039093 Intergraph Corp., Federal Systems Div., Huntsville, AL USA

USAF Logistics Process Optimization Study for the Aircraft Asset Sustainment Process, Volume 2 *Final Report*

Adamson, Anthony; Tribble, Dorothy J.; Dec. 31, 1998; 249p; In English; Prepared in collaboration with Intergraph Corp., Huntsville, AL. ADA363883 ADA363884

Report No.(s): AD-A363885; AFLMA-199731101; No Copyright; Avail: CASI; A11; Hardcopy; A03; Microfiche

This USAF Logistics Process Optimization Study for the Aircraft Asset Sustainment Process -- Phase II Report is the second in a series of technical reports prepared under AELMA Project LM9731101. It is published as three separate volumes. Volume I, USAF Logistics Process Optimization Study for the Aircraft Asset Sustainment Process -- Phase II Report, discusses the result and cost/benefit analysis of testing three initiatives at Langley Air Force Base as possible solutions to several findings discussed in the Phase I Report, USAF Logistics Asset Sustainment As Is Process, Volume II, (To Be Models), contains the To-Be Retail Asset Sustainment Process Model displaying the activities and functions related to the improved processes for receipt, storage, issue and delivery of materiel as tested at Langley Air Force Base, Virginia Volume III, (Future Retail Aircraft Asset Sustainment Process Models,) is published as a stand-alone volume of this report. Volume III contains a discussion of the Reengineering Team's efforts in the development of a logistics process model for a more distant future asset sustainment scenario unconstrained by today's logistics information systems limitations. It also contains a process model reflecting the Reengineering Team's vision of the future asset sustainment process.

DTIC

*Logistics; Aircraft Models; Cost Effectiveness*

19990059663 Science Applications International Corp., Albuquerque, NM USA

Compensating for Latency Variations in Air-to-Air Missile Tand E Using Live Aircraft Linked to a Missile HWIL Simulation

McKee, Larry; Mar. 1998; 11p; In English; Presented at the Simulation Interoperability Workshop, Mar 98, Orlando, FL.

Report No.(s): AD-A359414; No Copyright; Avail: CASI; A03; Hardcopy; A01; Microfiche

The Live Fly Phase (LFP) of the Systems Integration Test (SIT) was executed by the Joint Advanced Distributed Simulation (JADS) Joint Test Force (JTF) and the 46th Test Wing at Eglin AFB, FL during 1997. The purpose of the SIT was to evaluate the utility of using advanced distributed simulation (ADS) to support cost-effective testing of an integrated missile weapon/launch aircraft system in an operationally realistic scenario. The SIT missions simulated a single shooter aircraft launching an air-to-air missile against a single target aircraft. In the LFP, the shooter and target were represented by live aircraft and the missile by a simulator. ADS techniques were used to link two live F-16 fighter aircraft flying over the Eglin Gulf Test Range to the AMRAAM AIM-120 hardware-in-the-loop (HWIL) simulation facility at Eglin. In order for this linking to have utility for the T&E of the AMRAAM missile under test, the latency variations between the live aircraft and the missile HWIL simulation facility had to be removed so that the aircraft entity state and missile launch data could be properly synchronized to the missile simulation. This paper presents the techniques used to synchronize inputs to the missile HWIL simulation and their effectiveness at achieving the

required degree of synchronization. Also, the resulting latency is characterized, and conclusions on T&E applications of the LFP ADS configuration are given.

DTIC

*F-16 Aircraft; Air to Air Missiles; Distributed Interactive Simulation; Hardware-In-The-Loop Simulation; Missile Tests*

19990060928 Federal Aviation Administration, William J. Hughes Technical Center, Atlantic City, NJ USA

Beechcraft 1900C Vertical Impact Test

McGuire, R. J.; Vu, T.; May 1999; 24p; In English

Report No.(s): PB99-149726; DOT/FAA/AR-TN99/25; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

In October 1995, a commuter category Beechcraft 1900 C airliner was subjected to a vertical impact drop test at the William J. Hughes Technical Center, Atlantic City International Airport, New Jersey. The purpose of this test was to measure the impact response of the fuselage, cabin floor, cabin furnishings (including standard and modified seats), and anthropomorphic test dummies. The test was conducted to simulate the vertical velocity component of a severe but survivable crash impact. A low-wing, 19-passenger fuselage was dropped from a height of 11'2" resulting in a vertical impact velocity of 26'8" per second. The airframe was configured to simulate a typical flight condition, including seats (normal and experimental), simulated occupants, and cargo. For the test the wings and engines were removed; the vertical and horizontal stabilizers were removed; the landing gear was removed; and the pilot and copilot seats were not installed. The data collected in the test and future tests will supplement the existing basis for improved seat and restraint systems for commuter category of Code of Federal Regulation, 14 CFR Part 23, airplanes.

NTIS

*Impact Tests; Beechcraft Aircraft; Stabilizers (Fluid Dynamics)*

## 06

### AIRCRAFT INSTRUMENTATION

*Includes cockpit and cabin display devices, and flight instruments.*

19990058450 Helsinki Univ. of Technology, Radio Lab., Espoo Finland

Mapping of U.S. Scatterers and Suppression of Scatter Errors

Hahkio, T. L.; Nov. 12, 1998; 74p; In English

Report No.(s): PB99-133472; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

This thesis deals with multipath scatter disturbances in the Instrument Landing System (ILS) of the civil aviation, their properties, methods of suppressing them during flight, and calculation methods for their mapping on the basis of the data contained in the flight inspection records. Simulated examples as well as results obtained from inspection flights in Kajaani, Kauhava, Kunsamo and New Delhi are shown, compared and discussed.

NTIS

*Instrument Landing Systems; Multipath Transmission; Scattering; Landing Aids*

## 07

### AIRCRAFT PROPULSION AND POWER

*Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors, and onboard auxiliary power plants for aircraft.*

19990053514 Howard (Paul L.), Newmarket, NH USA

A Straw Man for the Integration of Vibration and Oil Debris Technologies

Howard, Paul L.; Howard (Paul L.), USA; Reintjes, John, Naval Research Lab., USA; Workshop on Helicopter Health and Usage Monitoring Systems; February 1999, pp. 131-136; In English; See also 19990053503; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P.O. Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

Diagnosis of faults in mechanical systems has traditionally involved analysis of vibration data and analysis of oil borne debris captured by magnets placed in the lubricating oil stream and has relied heavily upon trained expert analysis of data. Because the technologies are expert intensive and quite different in practice, they have remained basically separate analytical technologies. Each technology requires specific expert interpretation of data. Generally, neither answers the question "what's failing and how bad is it?". Data in "g's rms." and "parts per million of iron" will normally be compared to limit values. This usually occasions



review by a trained technician to determine the course of action to be followed and may or may not signal the existence of a problem. Optical analysis of oil borne debris by experienced technicians can provide additional information on machine condition well in advance of failure, but the accuracy of the analysis is still highly dependent on the capability of the human expert. Attempts to automate these analysis processes have mostly been rewarded by a high incidence of false alarms. Operators of early HUMS systems overcame these limitations by employing human expert analysis of data. Sometimes multiple indications were required before a problem was recognized. Currently HUMS systems must rely almost exclusively upon vibration analysis for detection of most faults, partly because automation of oil debris analysis has fallen behind basic HUMS technology development. While some of the critical HUMS detectable faults do not produce significant levels of oil borne debris, there are many that do. Reliance on prior technology, such as chip detectors and particle sensors / counters, has not allowed development of a truly robust, low false alarm rate, mechanical diagnostic system. New oil debris technology, such as LaserNet, which directly identifies the surface fatigue fault model(s) from particle shape, can assess severity, and trend growth of significant faults could provide a way forward for integration of vibration and oil debris technologies to produce a superior diagnostic approach. This paper identifies some current technology roadblocks and offers a straw man framework for such an integration process.

Derived from text

*Failure; Dynamic Structural Analysis; Lubricating Oils; False Alarms*

19990053519 Institute for Aerospace Research, Ottawa, Ontario Canada

Developments in Non-Intrusive Diagnostics for Engine Condition Monitoring

Bird, Jeff W., Institute for Aerospace Research, Canada; Mulligan, M. F., Institute for Aerospace Research, Canada; MacLeod, J. D., Institute for Aerospace Research, Canada; Little, D., National Defence Headquarters, Canada; Workshop on Helicopter Health and Usage Monitoring Systems, February 1999, pp. 203-216. In English. See also 19990053503; Copyright. Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P.O. Box 4331, Melbourne, Victoria 3001, Australia). Hardcopy, Microfiche

Knowledge of the condition of a gas turbine engine is essential for both flight safety and cost effective operations, particularly in the military environment with severe operating conditions, critical missions and limited fleets. One option is for military operators to look for new engine condition assessment tools. However, these tools must be practical for use on an operational base or at least in an overhaul centre, if real benefits are to be seen. Non-intrusive sensors using thermal radiation and spectroscopic analysis appear as promising technologies. The Institute for Aerospace Research of the National Research Council of Canada is working with the Canadian Department of National Defence to assess the effectiveness of these two, engine condition monitoring methods. The real-time, online capabilities of these two methods are of particular interest. Results of bench and implanted fault studies are shown for the infrared thermography study, demonstrating fault isolation in a test cell environment. Limited implanted fault tests with actual turbine runs in a J85 turbojet are also reported to demonstrate early promising results for the use of spectroscopy. Field usage assessments are a key part of the overall project; some details are given of the use of the thermography tool at an overhaul centre and also on the flight line.

Author

*Nonintrusive Measurement; Turbojet Engines; Faults; Diagnosis; Gas Turbine Engines*

19990053567 Naval Postgraduate School, Monterey, CA USA

Thrust Augmentation for a Small Turbojet Engine

Hackaday, Gary L.; Mar. 1999; 90p; In English

Report No.(s): AD-A362981; No Copyright. Avail: CASI; A05; Hardcopy; A01; Microfiche

A Sophia J450 (nine pounds of thrust) gas turbine engine was used first to examine the thrust augmentation generated using an ejector shroud. Experimental results obtained with and without the ejector were compared with performance predicted using an engine code and a one-dimensional ejector analysis. The engine code was revised to incorporate a radial turbine and the correct compressor map. Thrust augmentation of 3-10% was measured and the trends were correctly predicted. Second, an engine shroud was designed and installed around the engine and flow measurements were conducted to determine the entrainment rate in the shroud. The engine shroud was the initial step toward designing a turbofanjet.

DTIC

*Thrust Augmentation; Turbofanjet Engines; Aircraft Engines; Gas Turbines*

19990054416 Johns Hopkins Univ., Whiting School of Engineering, Columbia, MD USA

JANNAF Airbreathing Propulsion Subcommittee and 35th Combustion Subcommittee Meeting, Volume I

Fry, Ronald S.; Gannaway, Mary T.; Rognan, Melanie; Dec. 1998; 73p; In English, 7-11 Dec. 1998, Tucson, AZ, USA

Contract(s)/Grant(s): SP0700-97-D-4004



Report No.(s): AD-A363687; CPIA-PUB-682-VOL-1; No Copyright; Avail: Availability: CPIA, 10630 Little Patuxent Parkway, Suite 202, Columbia, MD 21044-3204, Microfiche

This document, CPIA Publication 682, Volume I, is a compilation of 5 unclassified/unlimited technical papers (approved for public release) which were presented at the 1998 meeting of the Joint Army-Navy-NASA-Air Force (JANNAF) Airbreathing Propulsion Subcommittee (APS) and Combustion Subcommittee (CS) held jointly with the Propulsion Systems Hazards Subcommittee (PSHS). The meeting was held on 7-11 December 1998 at Raytheon Systems Company and the Marriott Hotel, Tucson, AZ. Topics covered include HyTech technology development, hydrocarbon fuel development for hypersonic applications, pulse detonation propulsion system development and arc heaters for direct-connect scramjet testing.

DTIC

*Air Breathing Engines; Propulsion System Configurations; Propulsion System Performance; Hydrocarbon Fuels; Systems Engineering*

19990054726 American Robot Corp., Oakdale, PA USA

Retirement for Cause/Engine Structural Integrity Program: Advanced Capability Motion Controller *Final Report, Aug. 1996 - Apr. 1998*

Collins, Peyton, American Robot Corp., USA; Oct. 16, 1998; 31p; In English

Contract(s)/Grant(s): F33615-96-C-5259; AF Proj. 3153

Report No.(s): AD-A363487; AFRL-MIL-WP-TR-1998-4199; No Copyright; Avail: CASI: A03, Hardcopy: A01, Microfiche

The Air Force has developed, tested, and implemented an on-line-replacement upgrade for its Retirement for Cause (RFC) capability. It has replaced an expensive, custom designed, obsolete, green screen/numeric keypad controller with a commercial off the shelf, Windows NT, active matrix touch screen PC with better motion controlled performance and approximately half the cost. Four systems have been installed to date and are operational.

DTIC

*Aircraft Engines; Robots; Structural Failure*

## 08

### AIRCRAFT STABILITY AND CONTROL

*Includes aircraft handling qualities: piloting, flight controls; and autopilots.*

19990054417 Ohio State Univ., Dept. of Aerospace Engineering Applied Mechanics and Aviation, Columbus, OH USA

New Control Design Techniques Tailored to Smart Structural Systems *Final Report, 5 May 1997 - 5 Jun. 1998*

Yedavalli, R. K.; Nov. 1998; 48p; In English

Contract(s)/Grant(s): F33615-97-1-3207; AF Proj. 2302

Report No.(s): AD-A363850; AFRL-VA-WP-TR-1998-3080; No Copyright; Avail: CASI: A03, Hardcopy: A01, Microfiche

In this research, a new observer based control design specifically tailored to smart aeroelastic systems is presented. This truly multi-disciplinary system of an elastic structure with piezoelectric actuating and sensing under external aerodynamic load is modeled with an integrated finite element method. A new control design algorithm based on

DTIC

*Piezoelectricity; Finite Element Method; Detection; Control Systems Design*

19990054645 NASA Langley Research Center, Hampton, VA USA

Transonic Flutter Suppression Control Law Design, Analysis and Wind-Tunnel Results

Mukhopadhyay, Vivek, NASA Langley Research Center, USA; 1999; In English; Aeroelasticity and Structural Dynamics 1999, 22-25 Jun. 1999, Williamsburg, VA, USA

Report No.(s): IFA-1999; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The benchmark active controls technology and wind tunnel test program at NASA Langley Research Center was started with the objective to investigate the nonlinear, unsteady aerodynamics and active flutter suppression of wings in transonic flow. The paper will present the flutter suppression control law design process, numerical nonlinear simulation and wind tunnel test results for the NACA 0012 benchmark active control wing model. The flutter suppression control law design processes using (1) classical, (2) linear quadratic Gaussian (LQG), and (3) minimax techniques are described. A unified general formulation and solution for the LQG and minimax approaches, based on the steady state differential game theory is presented. Design considerations for improving the control law robustness and digital implementation are outlined. It was shown that simple control laws when properly designed based on physical principles, can suppress flutter with limited control power even in the presence

of transonic shocks and flow separation. In wind tunnel tests in air and heavy gas medium, the closed-loop flutter dynamic pressure was increased to the tunnel upper limit of 200 psf. The control law robustness and performance predictions were verified in highly nonlinear flow conditions, gain and phase perturbations, and spoiler deployment. A non-design plunge instability condition was also successfully suppressed.

Author

*Transonic Flutter; Control Theory; Design Analysis; Wind Tunnel Tests; Nonlinearity; Unsteady Aerodynamics; Retarding*

19990054844 ETREMA Products, Inc., Ames, IA USA

Integrated Electric Actuator Application to Flight Control Technology *Final Report*

Hammer, Natalie; Bright, Charles B.; Dec. 17, 1998; 22p; In English

Contract(s)/Grant(s): F33615-98-C-3604

Report No.(s): AD-A359476; No Copyright; Avail: CASI; A03; Hardcopy; A01; Microfiche

This report summarizes the work accomplished during SBIR AF98-175, "Integrated Electric Actuator Application to Flight Control Technology." ETREMA Products, Incorporated refers to this program as the Vulkan(TM) IEA program or as the TEA. The development of an IEA is key to achieving lighter, simpler, more reliable, and more cost-effective vehicle control systems. Phase I focused on modeling to demonstrate the feasibility of the IEA to produce sufficient fluid flow at sufficient pressure to perform work. TERFENOL-D transducers drove a piston, an inlet poppet valve, and an outlet poppet valve. Predicted fluid output power peaked at 632 watts (0.85 hp). Active valve controllability is a significant challenge.

DTIC

*Flight Control; Electromechanical Devices; Controllability; Hydraulic Equipment; Actuators*

19990060322 NASA Dryden Flight Research Center, Edwards, CA USA

Initial Flight Test of the Production Support Flight Control Computers at NASA Dryden Flight Research Center

Carter, John, NASA Dryden Flight Research Center, USA; Stephenson, Mark, NASA Dryden Flight Research Center, USA; August 1999; 19p; In English; Guidance, Navigation, and Control, 9-11 Aug. 1999, Portland, OR, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 529-30-24

Report No.(s): NASA/TM-1999-206581; H-2343; NAS 1.15:206581; AIAA Paper 99-4203; No Copyright; Avail: CASI; A03; Hardcopy; A01; Microfiche

The NASA Dryden Flight Research Center has completed the initial flight test of a modified set of F/A-18 flight control computers that gives the aircraft a research control law capability. The production support flight control computers (PSFCC) provide an increased capability for flight research in the control law, handling qualities, and flight systems areas. The PSFCC feature a research flight control processor that is "piggybacked" onto the baseline F/A-18 flight control system. This research processor allows for pilot selection of research control law operation in flight. To validate flight operation, a replication of a standard F/A-18 control law was programmed into the research processor and flight-tested over a limited envelope. This paper provides a brief description of the system, summarizes the initial flight test of the PSFCC, and describes future experiments for the PSFCC.

Author

*Aircraft Control; Flight Control; Airborne/Spaceborne Computers; Production Management; Flight Tests*

19990061201 NASA Dryden Flight Research Center, Edwards, CA USA

Gain-Scheduled Approximations to H-Infinity Controllers for the F/A-18 Active Aeroelastic Wing

Lind, Rick, NASA Dryden Flight Research Center, USA; 1999; In English

Report No.(s): AIAA Paper 99-4205; Copyright; Avail: Issuing Activity; Hardcopy; Microfiche

The Active Aeroelastic Wing will demonstrate technologies related to aeroservoelastic effects such as wing twist and load minimization. This paper presents a control design based on H-infinity synthesis that simultaneously considers the multiple objectives associated with handling qualities, actuator limitations, and loads. The controller is realized as a filter and gain set approximation to a state-space H-infinity controller. This approximation allows scheduling of the controller over a flight envelope.

Author

*Aeroservoelasticity; H-Infinity Control; Flight Envelopes; Control Systems Design; Feedback Control; Flight Simulation; Controllers; Aeroelastic Research Wings; Flight Control; Control Simulation; Active Control*

19990061213 NASA Langley Research Center, Hampton, VA USA

Chaotic Response of Panel Vibrations Forced by Turbulent Boundary Layer and Sound

Maestrello, L., NASA Langley Research Center, USA; AIAA Journal; March 1999; Volume 37, No. 3, pp. 289-295; In English; 3rd, Aeroacoustics, 12-14 May 1997, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA Report No.(s): AIAA Paper 97-1688; Copyright; Avail: Issuing Activity; Hardcopy, Microfiche

Experimental data are presented to show evidence of chaotic response of two adjacent aircraft panels forced by a turbulent boundary layer and pure tone sound. The experiments are a simulation of boundary-layer and fan noise loads on a fuselage sidewall with Reynolds number per meter of  $2.85 \times 10^6$  (exp 5). The response of the panels is purely random and assumed linear when forced by the turbulent boundary-layer flow and clearly becomes nonlinear with the appearance of the interspersed periodic to chaotic motion when forced by the boundary layer with superimposed pure tone sound. The initial periodic response of two tori of two commensurate frequencies changes with an increase in pure tone sound level. The response of period-doubling bifurcations then makes a transition to chaos, which alternates with quasiperiodic response as the wave loses the spatial homogeneity. The objective is to demonstrate the existence of strong nonlinear effects on the structure response, which is not yet well understood.

Author

*Chaos; Aerodynamic Noise; Turbulent Boundary Layer; Reynolds Number; Fuselages; Dynamic Response; Acoustic Excitation; Panel Flutter; Aeroacoustics*

## 09

### RESEARCH AND SUPPORT FACILITIES (AIR)

*Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.*

19990058200 Royal Aeronautical Society, London, UK

Third Test and Evaluation International Aerospace Forum. The Management and Technology Trends of Ranges and Facilities into the 21st Century: Proceedings

1998, In English, 3rd, 23-25 Jun. 1998, London, UK; See also 19990058201 through 19990058214; ISBN 1-85768-054-5; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK); Hardcopy, Microfiche

Contents include the following: Test and evaluation in the new millennium - a european industrial perspective. Integration and operation of T & E ranges in trading environment. Selling change in the "new" Boeing company: integrating 600 laboratories. The development of German military aerospace testing-managing the last 50 years. Test range-a profit center? The Israeli experience. Distributed simulation and test and evaluation: a midterm report on the utility of advanced distributed simulation to test and evaluation. British and USA participation in a demonstration of GPS range instrumentation. The evolution of optical tracking facilities within UK test and evaluation ranges. Validation of future gas turbine technology by BR700 Core demonstrator engine test in the Stuttgart university altitude test facility. Also include testing the virtual aeroplane and Changing requirements for aerial targets.

CASI

*Conferences; Performance Tests; Evaluation; Altitude Tests; Engine Tests; Management Systems; Technology Assessment; Test Facilities; Test Ranges*

19990058202 Defence Evaluation Research Agency, Boscombe Down, UK

Integration and Operation of T and E Ranges in a Trading Environment

Rigden, Chris, Defence Evaluation Research Agency, UK; Third Test and Evaluation International Aerospace Forum. The Management and Technology Trends of Ranges and Facilities into the 21st Century: Proceedings; 1998, pp. 5.1-5.8; In English; See also 19990058200; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK); Hardcopy, Microfiche

This paper describes changes that are being made to adapt the UK Ministry of Defence Test and Evaluation (T&E) Ranges, so that they meet the challenges of the future. These changes are being made to the way in which the ranges are managed, operated and funded, and a case history is presented to illustrate the potential benefits of the changes. A clear lesson to emerge is that partnerships with customers and between National and International suppliers of T&E range services are necessary to ensure we get the best value for money from our expensive ranges and facilities.

Author

*Evaluation; Ranges (Facilities); Research Facilities*

19990058203 Boeing Information, Space and Defense Systems, Phantom Works, Seattle, WA USA

*Selling Change in the "New" Boeing Company: Integrating 600 Laboratories*

Newman, William E., Boeing Information, Space and Defense Systems, USA; Jablonski, Richard J., Boeing Information, Space and Defense Systems, USA; Third Test and Evaluation International Aerospace Forum. The Management and Technology Trends of Ranges and Facilities into the 21st Century: Proceedings, 1998, pp. 6.1-6.5; In English. See also 19990058200; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The Information, Space and Defense Systems (ISDS) Group of The "new" Boeing Company bears slight resemblance to the former Boeing Defense and Space Group. The merger of Boeing with Rockwell and then McDonnell Douglas created a complex marriage of different product lines, cultures, accounting systems, personnel systems, and management styles. Our differences became particularly obvious when we considered the options of how to integrate the heritage management philosophies and operating systems for the combined 600 Research, Development, Test & Evaluation (RDT&E) laboratories and test facilities of these three companies. A fundamental question was how to strategically integrate and manage similar yet widely separated lab resources, operate them as a business in order to maximize operational efficiency, and yet optimize support to customers, regardless of lab location. In November 1997 the Information, Space and Defense Systems Group created Enterprise Laboratories, a new Group-wide laboratory management organization under Phantom Works, one of the four business units of the new Group. Chartered to make strategic consolidation recommendations as their initial thrust, Enterprise Laboratories was the Group's first organizational element to operate across all sites and business units. Their goal was to find new efficiencies and attendant savings through the consolidation of laboratory assets across the former companies, to reverse an old adage, the sum should be less than the parts. Three months later Enterprise Laboratories presented 145 recommendations, nearly equally divide between closures and consolidations, totaling \$100 million in 5-year gross savings. Group leadership approved these recommendations in March 1998. Along with this approval, they also chartered a new management philosophy for these 600 general usage labs and renamed the organization ISDS Laboratories. The tasks of ISDS Laboratories now center on delivering this first round of identified savings while finding ways to provide laboratory managers and their customers additional increased efficiencies, to achieve this goal the existing management of the heritage companies must also take ownership of the change process. In short, all management levels must believe that the end state will benefit their customers, their people, and themselves. The new voyage has begun but is far from over.

Author

*Systems Management; Commerce; Consolidation; Efficiency; Management Systems; Research Management*

19990058204 Rafael Armament Development Authority, EW Test Range and Instrumentation Dept., Haifa, Israel

*Test Range, a Profit Center? The Israeli Experience*

Leshem, Aaron, Rafael Armament Development Authority, Israel; Third Test and Evaluation International Aerospace Forum. The Management and Technology Trends of Ranges and Facilities into the 21st Century: Proceedings, 1998, pp. 8.1-8.5; In English. See also 19990058200; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

Rafael's WTEC has grown together with weaponry development in Israel. In the last decade, the Israeli MOD budget for armament development has been reduced which implied less new armament developments. This result in fewer test missions to be performed at WTEC. This article presents WTEC experience and strategy to face the challenge of being more efficient in performing the T & E mission. This goal is achieved by enhancing the productivity and reengineering the T & E process.

Author

*Test Ranges; Productivity*

19990058205 Joint Advanced Distributed Simulation Joint Test Force, Albuquerque, NM USA

*Distributed Simulation and Test Evaluation: A Midterm Report on the Utility of Advanced Distributed Simulation to Test and Evaluation*

Smith, Mark E., Joint Advanced Distributed Simulation Joint Test Force, USA; McKee, Larry, Science Applications International Corp., USA; Third Test and Evaluation International Aerospace Forum. The Management and Technology Trends of Ranges and Facilities into the 21st Century: Proceedings, 1998, pp. 9.1-9.12; In English. See also 19990058200; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The Joint Advanced Distributed Simulation Joint Test Force (JADS JTF) is chartered by the U.S. Office of the Secretary of Defense (OSD) to determine the utility of advanced distributed simulation (ADS) for both developmental and operational test and evaluation (DT&E and OT&E). The program is at its midpoint, and this paper is designed to provide a progress report on the lessons learned to date on the use of ADS in test and evaluation (T&E). The paper opens with a brief overview of ADS technology and then a short description of the JADS Joint Test and Evaluation (JT&E) program. Third, the main portion of the paper will



discuss the results and lessons learned during the ADS-enhanced testing conducted throughout the first major phases of the JADS T&E program. Fourth, the JADS study on the linking of electronic warfare (EW) test facilities, the Threat Systems Linking Architecture (TSLA) Study, is briefly described. Finally, other considerations will be offered for the T&E professional interested in whether ADS might be a suitable test tool. The material in this paper fuses material from other JADS documents prepared by many members of the JADS JTF.

Author

*Architecture (Computers); Simulation; Test Facilities*

19990058206 Tri-Service GPS Range Applications Steering Committee, Washington, DC USA

British and USA Participation in a Demonstration of GPS Range Instrumentation

Ellis, William, Tri-Service GPS Range Applications Steering Committee, USA; Travis, Peter, British Aerospace Defence Ltd., UK; Ramondo, Nat, Analytic Sciences Corp., USA; Third Test and Evaluation International Aerospace Forum, The Management and Technology Trends of Ranges and Facilities into the 21st Century: Proceedings; 1998, pp. 10.1-10.5; In English; See also 19990058200, Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The USAF has developed a GPS-based TSPI system for use on major T & E DoD ranges BAE Flight Test Department is purchasing a similar system. BAE desired to have a demonstration of the DoD system. The two organizations agreed to conduct this demonstration in the February and March 1996 time period. The demonstration took place at the British Aerospace Military Aircraft Division, Warton Flight Test Center Lancashire, England. This paper describes the assets used for the demonstration and the results of the demonstration.

Author

*Global Positioning System; Flight Tests; Product Development*

19990058207 Defence Evaluation Research Agency, Optical Instrumentation, Aberporth, UK

The Evolution of Optical Tracking Facilities Within UK Test and Evaluation Ranges

Lees, Jonathan, Defence Evaluation Research Agency, UK; Third Test and Evaluation International Aerospace Forum, The Management and Technology Trends of Ranges and Facilities into the 21st Century: Proceedings; 1998, pp. 11.1-11.9; In English; See also 19990058200, Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The need to optically track fast moving targets with great accuracy has always been a prime objective of Test and Evaluation Ranges. During the Second World War the kinematic theodolite, commonly known as the kinetheodolite was developed for this purpose and although many improvements have been made since then, the principles of operation have not significantly changed. As defence technology advanced, new, more challenging demands were placed upon optical tracking instrumentation. Targets became more dynamic and complex and customers soon started calling for greater degrees of accuracy, faster image frame rates and improved image quality. These new requirements eventually prompted a feasibility study to investigate a replacement for the kinetheodolite and this in turn led to the development of the modern day Electro-Optical Tracking Instrument (EOTI). These mobile instruments are capable of automatically tracking small, very fast moving objects at increased ranges. They have excellent angular resolutions and their multisensor platforms are capable of high rates of angular acceleration and the video frame rates necessary to meet the demands of present and future customer requirements. This paper presents a historical case study of the changes in optical tracking within Ranges concentrating upon the evolution of the early kinetheodolite into the modern day and future EOTI.

Author

*Theodolites; Optical Tracking; Image Resolution; Feasibility; Electro-Optics; Research Facilities*

19990058208 BMW Rolls-Royce AeroEngines G.m.b.H., Dahnlewitz, Germany

Validation of Future Gas Turbine Technology by BR700 Core Demonstrator Engine Tests in the Stuttgart University Altitude Test Facility

Menrath, Martin, BMW Rolls-Royce AeroEngines G.m.b.H., Germany; Schmidt, Klaus-J., BMW Rolls-Royce AeroEngines G.m.b.H., Germany; Merten, Ralph, BMW Rolls-Royce AeroEngines G.m.b.H., Germany; Braig, Wolfgang, Technische Hochschule, Germany; Third Test and Evaluation International Aerospace Forum, The Management and Technology Trends of Ranges and Facilities into the 21st Century: Proceedings; 1998, pp. 12.1-12.14; In English; See also 19990058200, Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

After the formation of BMW Rolls-Royce in July 1990, the company was concentrated on design, manufacturing and marketing the BR700 engine family, which covers the 12,000 to 22,000 lbs thrust range. The BR710, the first variant of the family,

achieved full certification 48 months after programme launch. The BR715, the second variant of the family, will be certified in only 37 months after launching the project. For future civil engines the trend is likely to go down to a 30 months product development cycle. To de-risk the development programmes, strategies must be set in place which allow the introduction of advanced technologies with an acceptable level of risk. Consequently, advanced technology must be built up in separate research and technology acquisition programmes. The validation of the most promising technologies has to take place in a representative engine environment in order to minimise the risk for future applications. BMW Rolls-Royce therefore decided to use the BR700 engine as platform for component validation and certification tests at the "Institut für Flugantriebe" at the University of Stuttgart. This paper describes the set-up of the Stuttgart ATF for core testing and gives some examples of how the BR710 and BR715 development programmes have been de-risked by using the core vehicle as a mean of technology readiness demonstration. In addition, the strategy is briefly described how to use core testing as a technology demonstration strategy for the 21st century.

Author

*Gas Turbines; Technology Assessment; Test Facilities; Proving; Engine Tests; Manufacturing*

19990058210 Institute for Defense Analyses, Alexandria, VA USA

*The Use of Modeling and Simulation in the Operational Test of Military Aircraft: Promises and Challenges*

Wiesenhuber, David, Institute for Defense Analyses, USA; Dighton, Robert, Institute for Defense Analyses, USA; Third Test and Evaluation International Aerospace Forum. The Management and Technology Trends of Ranges and Facilities into the 21st Century: Proceedings, 1998, pp. 15.1-15.9, In English. See also 19990058200, Copyright, Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The capabilities of modeling and simulation (M&S) have grown tremendously during the past decade. As M&S matures, defense officials are starting to examine the possibility of using this technology to improve the acquisition and employment of military systems. Potential applications include research, development, and engineering of new systems; test and evaluation; and training. Each of these applications has different simulation requirements that must be understood before simulation development begins, especially since the distributed, interactive, graphics-intensive systems typical of modern simulation programs have historically been developed for training applications. This paper describes the general requirements that operational testers of military aircraft will place on M&S if it is to be accepted by the test and evaluation community. Test and evaluation - and in particular operational test and evaluation (OT&E) - may pose some of the greatest challenges to M&S developers, but, because of the limitations inherent in the large field tests characteristic of operational testing, OT&E users could benefit greatly from modeling and simulation to improve their test programs. More work needs to be done in M&S development, and the challenges facing the M&S community are discussed in this paper.

Author

*Models; Field Tests; Computerized Simulation*

19990058212 Institute for Defense Analyses, Alexandria, VA USA

*A Future Instrumentation Concept, Suitable for Test and Training*

Burski, Michael L., Institute for Defense Analyses, USA; Third Test and Evaluation International Aerospace Forum. The Management and Technology Trends of Ranges and Facilities into the 21st Century: Proceedings, 1998, pp. 18.1-18.5, In English. See also 19990058200, Copyright, Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

A desire for future instrumentation is the ability to provide data for both test and training users during a single event. Conventional wisdom assumes that there are significant advantages to performing both together. Efficiencies of resource use (time, people, money and equipment) are the expected advantages. The design of a single tool (read: instrumentation system) seems feasible. This paper proposes a conceptual tool that is basic enough to be valuable to both communities without being expensive, complex, biased or restrictive. A need common to both users is position of participants. The instrumentation design is then determined by answers to the following questions: How many participants need to be monitored? What are the types of participants? Where is the event performed (size, location and environment of the sandbox)? What accuracy is needed? When and where is the data needed (feedback, display, archiving)? What will the tool cost? When can I use it? What are its care and feeding requirements? Past and existing systems had specific needs based on performing a specific task. Testers and trainers are different from each other. Their needs, events and methods are different. I am proposing a time, space, position information (TSPI) system concept that will be sufficient for both groups in the majority of their endeavors. The proposed system will use two technologies to achieve its objective: providing suitable and efficient TSPI for both types of users during a single event. The two technologies are the Global Positioning System (GPS) and a low-earth-orbit satellite system. The first is capable of determining

suitable and efficient TSP. The second is potentially capable of communicating that data, suitably and efficiently, to its appropriate destination.

Author

*Training Devices; Performance Tests; Information Systems; Communicating; Bias*

19990058213 Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA

Will Facilities be Required? Virtual Testing Shapes Future of Test Facility Requirements

Pollard, Raymond G., III, Army Test and Evaluation Command, USA; Stevenson, Todd E., Army Test and Evaluation Command, USA; Third Test and Evaluation International Aerospace Forum, The Management and Technology Trends of Ranges and Facilities into the 21st Century: Proceedings, 1998, pp. 19.1-19.7; In English; See also 19990058200; Copyright; Avail. Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK); Hardcopy; Microfiche

Advances in physics based computer modeling, simulation, and visualization are allowing the U.S. Army's Test and Evaluation Command to create synthetic environments for a wide range of systems. These synthetic environments are being used to exercise computer models of new weapons systems in order to plan the subsequent "real-world" testing in an actual facility at a test range. Experience is showing that cost effective test programs are being designed with greater emphasis on the "computer model in synthetic environment" and "hardware-in-the-loop" activities, with less time spent in a "realworld" test range or facility verifying predicted outcomes. Such a trend has enormous implications for decisions on where to place scarce test technology resources in the 21st century. This paper will present a coherent strategy for prioritizing investments in synthetic environments, based on developments in modeling and simulation, coupled with cost-benefit analyses of the synthetic versus real-world tradeoffs. Examples will be presented of the decisions being made today that affect both the management of U.S. Army test ranges and facilities, and the investments that are needed to assure a viable testing capability for the 21st century.

Author

*Computerized Simulation; Physical Exercise; Ranges (Facilities); Test Facilities*

19990058601 Surrey Univ., School of Mechanical and Materials Engineering, Guildford, UK

Some Aspects of Centrifugal Fan Characteristics in Blower Windtunnels

Johnson, A. E., Surrey Univ., UK; Hancock, P. E., Surrey Univ., UK; The Aeronautical Journal; December 1997; Volume 101, No. 1010, pp. 481-485; In English; See also 19990058597

Report No.(s): Paper-2354; No Copyright; Avail. CASE; A01; Hardcopy; A01; Microfiche

Measurements have been made in the exit flows of the fan, diffuser, settling chamber and contraction of a low speed blower windtunnel driven by a centrifugal fan. A velocity deficit and streamwise vortex were observed at the diffuser exit when the fan was operating at less than about 0.9 of maximum efficiency but not when operating above. Unacceptably large unsteadiness (approx. 0.7% rms) occurred at low speeds when the fan speed was increased from rest, but not when the fan speed was decreased from full speed. This unsteadiness was at the rotor frequency and appears to have been caused by laminar boundary layer separation on one or more adjacent aerofoil blades, coupled with slight asymmetry in the rotor. Unsteadiness at the rotor frequency and of comparable magnitude has also been seen in another. Larger fan, but was not eliminated in the same way. Attaining high quality flow is likely to require careful attention to the characteristics of individual fans.

Author

*Centrifugal Force; Frequencies; Fans; Flow Measurement*

19990058602 San Diego State Univ., San Diego, CA USA

Transonic Flow Over Wavy Walls: A New Solution Procedure Compared With Experiments

Narang, B. S., San Diego State Univ., USA; Ho, J., San Diego State Univ., USA; The Aeronautical Journal; December 1997; Volume 101, No. 1010, pp. 487-493; In English; See also 19990058597

Report No.(s): Paper-2241; No Copyright; Avail. CASE; A02; Hardcopy; A01; Microfiche

A new method has been used to solve the transonic flow equation for flow over a wavy wall. The results thus obtained are compared with those obtained from windtunnel experiments. A new fluctuating flow phenomenon has been observed both in the experiment and in numerical calculations which may enhance flow mixing. The numerical results also indicate that the flow becomes locally sonic for a transonic parameter value greater than 0.5, while experimental data indicate a value of 0.6363 for the transonic parameter. The classical value of transonic parameter has a value of one for the flow to become locally sonic.

Author

*Transonic Flow; Walls; Procedures; Numerical Analysis*

19990053698 Georgia Inst. of Tech., School of Civil Engineering, Atlanta, GA USA

Multi-Channel Data Acquisition System for Nondestructive Testing of Airbase Facilities. *Final Report, 1 Feb. 1998 - 31 Jan. 1999*

Ris, Glenn J.; May 08, 1999; Sp; In English

Contract(s)/Grant(s): F49620-98-1-0233

Report No.(s): AD-A363815; No Copyright; Avail: CASI; A01; Hardcopy: A01; Microfiche

A multi-channel data acquisition system including a variety of sources and receivers was purchased to support research at Georgia Tech aimed at the Air Force's need to develop innovative airbase technologies. The equipment purchased comprises a complete multi-channel system for acquiring, processing, analyzing, and displaying dynamic signals. The system provides the capability to more accurately and rapidly perform nondestructive tests, and has thus far been used on two research efforts involving dynamic measurements. On one project involving a USAF Palace Knights student, a comprehensive experimental study was conducted to investigate the suitability of a modal analysis approach for identification of unknown pile embedment lengths. The second project is aimed at developing a non-invasive field technique that uses the dispersion properties of surface waves to determine the shear wave velocity profile at a site. The technique uses passive measurements of surface waves arising from microtremors and/or cultural noise such as traffic. Surface wave dispersion relationships are determined using frequency-wavenumber analyses.

DTIC

*Frequencies; Data Acquisition; Airports; Wave Dispersion; Velocity Distribution*

## 10

### ASTRONAUTICS

*Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; space communications; spacecraft communications; command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.*

19990053854 NASA Johnson Space Center, Houston, TX USA

NASA Orbiter Extended Nose Landing Gear

King, Steven R.; Lockheed Martin Corp., USA; Jensen, Scott A.; Lockheed Martin Corp., USA; Hansen, Christopher P.; NASA Johnson Space Center, USA; 33rd Aerospace Mechanisms Symposium; May 1999, pp. 373-387; In English; See also 19990053852; No Copyright; Avail: CASI; A03; Hardcopy: A04; Microfiche

This paper discusses the design, development, test, and evaluation of a prototype Extended Nose Landing Gear (ENLG) for NASA's Space Shuttle orbiters. The ENLG is a proposed orbiter modification developed in-house at NASA's Johnson Space Center (JSC) by a joint government/industry team. It increases the orbiter's nose landing gear (NLG) length, thereby changing the vehicle's angle of attack during rollout, which lowers the aerodynamic forces on the vehicle. This, in combination with a dynamic elevon change, will lower the loads on the orbiter's main landing gear (MLG). The extension is accomplished by adding a telescoping section to the current NLG strut that will be pneumatically extended during NLG deployment.

Author

*Space Shuttle Orbiters; Landing Gear; Spacecraft Landing; Spacecraft Components; Systems Engineering; Mechanical Devices*

## 12

### ENGINEERING

*Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.*

19990053587 Koncar, Inst. za Elektrotehniko, Osijek, Croatia

Measurement of Stray No-Load Losses in Induction Motors. *Meritev Dodatnih Izgub Prostega Teča Trifaznih Asinhronskih Motorjev*

Stefanko, Stjepan; Koncar, Croatia; Zagradisnik, Ivan; Maribor Univ., Slovenia; Gajzer, Matej; Maribor Univ., Slovenia; Skennik, Bopun; Maribor Univ., Slovenia; *Electrotechnical Review*; 1998, Volume 65, Nos. 2-3, pp. 102-107; In Slovene; See also 19990053584; No Copyright; Avail: Issuing Activity (Elektrotehniški Vestnik, Fakulteta za Elektrotehniko, Trzaska 25, 10011 Ljubljana, Slovenia); Hardcopy; Microfiche



In induction motors at no-load stray no-load losses are present besides fundamental losses (stator winding losses, stator fundamental frequency core losses, friction and windage losses). The stray no-load losses are mostly located in the stator and rotor core laminations (surface and pulsation losses) and in the rotor winding. Also, in squirrel-cage induction motors with skewed rotor slots, there are losses due to the crossbar currents. The main part of the stray no-load losses are caused by the permeance waveform of the airgap due to slotting and the smaller part caused by the saturation of the main magnetic paths in the induction motor. The presentation of the permeance harmonics, due to slotting in the flux-density waveform, is described in Section 2. Also the excitation harmonics of the stator and rotor winding are given in this section. For the product of the same order harmonics of the excitation and the permeance the airgap induction is given. In Section 3, the paper describes a measurement method of stray no-load losses, known as the hysteresis jump. From the energy balance at the hysteresis jump the voltage depending stray no-load losses can be obtained.

Author

*Electric Control; Electric Potential; Slots; Rotors; Magnetic Induction; Harmonic Excitation*

19990053797 Defence Science and Technology Organisation, Melbourne Australia

Flow Visualization About the Helicopter Deck of the Hydrographic Ship

Edwards, Craig D., Defence Science and Technology Organisation, Australia; Mar. 1999, 135p. In English

Report No.(s): AD-A362877; DSTO-TR-0762; DODA-AR-010-842; No Copyright; Avail: CASE; A07, Hardcopy; A02, Microfiche

Flow visualisation tests were performed about the helicopter deck of a 1/35 scale model of the Hydrographic Ship in the Low Speed Wind Tunnel at the Aeronautical and Maritime Research Laboratory. The model was tested over a range of relative wind angles using tuft, smoke and surface flow visualisation techniques to determine regions of adverse airflow that may have a detrimental effect on helicopter-ship operations in order to meet certification requirements. In particular, turbulent flow in the vicinity of the flight deck, vertical replenishment area and the ship's anemometer installation were identified, photographed and recorded on video. Effects of two fixed ship roll angles on the flow were also investigated. This document contains extensive results for all model configurations tested and describes in detail the flow features observed.

DTIC

*Flow Visualization; Landing Gear; Landing Instruments; Wind Tunnel Models*

19990053808 Boston Univ., Dept. of Aerospace and Mechanical Engineering, Boston, MA USA

Trailing Edge Noise Evaluated at Very Low Mach Number from Incompressible Flow Simulations. *Final Report*

Howe, M. S.; Mar. 09, 1999; 59p. In English

Contract(s)/Grant(s): N00014-98-1-0798

Report No.(s): AD-A361764; AM-99-0003; No Copyright; Avail: CASE; A04, Hardcopy; A01, Microfiche

A review is made of the diffraction theory of the trailing edge noise generated by a flat-plate airfoil of zero-thickness and non-compact chord, according to which the sound is attributed to the scattering of a 'frozen' pattern of turbulence wall pressure swept over the edge in the mean flow. Extension is made to determine the sound produced by very low Mach number flow over the edge of an airfoil of finite thickness. In applications it is desirable to represent the noise in terms of a surface integral over the airfoil involving a Green's function and a metric of the edge flow that can be calculated locally using the equations of motion of an incompressible fluid. It is argued that the appropriate metric for a rigid airfoil is the incompressible 'upwash' velocity (determined by the Biot-Savart induction formula applied to the boundary layer vorticity outside the viscous sublayer), and not the surface pressure. Formula for calculating the noise are given when the airfoil thickness is acoustically compact, and for both three and two-dimensional edge flows. The theory is illustrated by a detailed discussion of a two-dimensional vortex flow over an airfoil with a rounded trailing edge. The problem is simple enough to be treated analytically, yet is also suitable for validating computational edge noise schemes.

DTIC

*Incompressible Flow; Flow Visualization; Computational Fluid Dynamics; Two Dimensional Flow; Aerodynamic Noise; Airfoil Profiles*

19990056592 NASA Langley Research Center, Hampton, VA USA

Crossflow Stability and Transition Experiments in Swept-Wing Flow, 1988-1989

Dagenhart, J. Ray, NASA Langley Research Center, USA; Saric, William S., Arizona State Univ., USA; July 1999; 150p. In English

Contract(s)/Grant(s): RTOP 522-31-11-03

Report No.(s): NASA/TP-1999-209344; NAS 1.60:209344; L-17658; No Copyright; Avail: CASE; A07, Hardcopy; A02, Microfiche

An experimental examination of crossflow instability and transition on a 45deg swept wing was conducted in the Arizona State University Unsteady Wind Tunnel. The stationary-vortex pattern and transition location are visualized by using both sublimating chemical and liquid-crystal coatings. Extensive hot-wire measurements were obtained at several measurement stations across a single vortex track. The mean and travelling wave disturbances were measured simultaneously. Stationary crossflow disturbance profiles were determined by subtracting either a reference or a span-averaged velocity profile from the mean velocity data. Mean, stationary crossflow, and traveling wave velocity data were presented as local boundary layer profiles and contour plots across a single stationary crossflow vortex track. Disturbance mode profiles and growth rates were determined. The experimental data are compared with predictions from linear stability theory.

Author

*Swept Wings; Transition Flow; Velocity Distribution; Traveling Waves; Cross Flow; Boundary Layers*

19990056427 Saint Petersburg State Electrotechnical Univ., Saint Petersburg, Russia

A System for Measuring Deformations of Large-Sized Objects

Mochalov, A. V., Saint Petersburg State Electrotechnical Univ., Russia; Optical Gyros and Their Application; May 1999, pp. 15-1 - 15-9; In English. See also 19990056413; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The discussions in this paper are as follows: a method for measuring static and dynamic deformations, observability and errors of the system, and a practical implementation of the method.

CASI

*Laser Gyroscopes; Inertial Navigation; Navigation Instruments; Flight Control*

19990053512 New South Wales Univ., School of Mechanical and Manufacturing Engineering, Sydney, Australia

Detection of Bearing Faults in Helicopter Gearboxes

Gao, Yujin, New South Wales Univ., Australia; Randall, R. B., New South Wales Univ., Australia; Workshop on Helicopter Health and Usage Monitoring Systems; February 1999, pp. 99-111; In English. See also 19990053503; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P.O. Box 4331, Melbourne, Victoria 3001, Australia); Hardcopy, Microfiche

Contents include the following: (1) Special analysis: requirement of baseline spectra and sideband growth and spectrum level increase. (2) Cepstral analysis: periodic structures in log spectra and better than Kurtosis. (3) Statistical parameters: applied to band pass filtered envelope signals and may produce confusing indication. (4) Envelope analysis: digital implementation; flexibility in choosing passbands; harmonic family and sidebands and combination with SANC. (5) CPB spectral analysis: wide frequency range with limited samples; comparison with mask; and stable detection information. (6) neural network: CPB spectrum analysis is a valid data preprocessor; good success rate with helicopter gearbox bearing faults (based on limited data) and the bearing fault in the gearbox test rig; too expensive to experience all the faults we would like to diagnose; and mathematical model and digital simulation.

CASI

*Fault Detection; Helicopters; Spectrum Analysis; Sidebands; Mathematical Models; Bearings; Transmissions (Machine Elements)*

19990053888 Sverdrup Technology, Inc., Moffett Field, CA USA

Remote Flap Actuation System for Large-Scale High-Speed Civil Transport Wind Tunnel Model

Kennon, J. E., Sverdrup Technology, Inc., USA; Bisbee, L. S., Sverdrup Technology, Inc., USA; Willink, M. P., Sverdrup Technology, Inc., USA; 33rd Aerospace Mechanisms Symposium; May 1999, pp. 431-446; In English. See also 19990053852; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The High-Lift Engine Aeroacoustic Technology (HEAT) wind tunnel model has been modified to incorporate remote actuation of the four trailing edge flaps. The cellular arrangement of the wing ribs and spars combined with the thinness of the wing and the requirement to maintain structural integrity imposes severe constraints on the packaging of the flap actuation mechanisms in the model. Simple motion linkage systems are utilized to transmit power from hydraulic cylinders to actuate each of the flap surfaces. This paper describes these individual linkage systems, the flap position measurement systems, problems encountered during the checkout phase, and overall system performance.

Author

*Wind Tunnel Models; Flaps (Control Surfaces); Remote Control; Mechanical Devices; Flapping; Design Analysis; Wind Tunnel Apparatus*

### 13 GEOSCIENCES

*Includes geosciences (general); earth resources and remote sensing; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography*

19990054141 NASA Goddard Space Flight Center, Greenbelt, MD USA

Assessment of the Effects of High-Speed Aircraft in the Stratosphere: 1998

Kawa, S. Randolph, NASA Goddard Space Flight Center, USA; Anderson, James G., Harvard Univ., USA; Baughcum, Steven L., Boeing Co., USA; Brock, Charles A., Denver Univ., USA; Brune, William H., Pennsylvania State Univ., USA; Cohen, Ronald C., California Univ., USA; Kinnison, Douglas E., National Center for Atmospheric Research, USA; Newman, Paul A., NASA Goddard Space Flight Center, USA; Rodriguez, Jose M., Miami Univ., USA; Stolarski, Richard S., NASA Goddard Space Flight Center, USA; Waugh, Darryn, Johns Hopkins Univ., USA; Wofsy, Steven C., Harvard Univ., USA; June 1999; 232p; In English Report No.(s): NASA/IP-1999-209237; Rept-99B00055; NAS 1.60:209237; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

This report assesses the potential atmospheric impacts of a proposed fleet of high-speed civil transport (HSCT) aircraft. The purpose of the report is to assess the effects of HSCT's on atmospheric composition and climate in order to provide a scientific basis for making technical, commercial, and environmental policy decisions regarding the HSCT fleet. The work summarized here was carried out as part of NASA's Atmospheric Effects of Aviation Project (a component of the High-Speed Research Program) as well as other NASA, U.S., and international research programs. The principal focus is on change in stratospheric ozone concentrations. The impact on climate change is also a concern. The report describes progress in understanding atmospheric processes, the current state of understanding of HSCT emissions, numerical model predictions of HSCT impacts, the principal uncertainties in atmospheric predictions, and the associated sensitivities in predicted effects of HSCT'S.

Author

*Atmospheric Composition; Atmospheric Effects; Civil Aviation; Transport Aircraft; Supersonic Commercial Air Transport; Ozone Depletion; Stratosphere*

19990054652 Lawrence Livermore National Lab., Livermore, CA USA

Initial Designs of Electric-Discharge Non-Thermal Plasma Field-Pilot Demonstration Units for NOx Removal in Jet-Engine Exhaust: White Paper for SERDP Project CP-1038

Rasocha, L. A., Lawrence Livermore National Lab., USA; Chang, J. S., Lawrence Livermore National Lab., USA; Miziolex, A. W., Lawrence Livermore National Lab., USA; Aug. 20, 1998; 16p; In English

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): AD-A363430; LA-UR-98-5345; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Incentives for implementing new pollution-control technologies are both regulatory and economic. Given considerable regulatory pressure, e.g., the promulgation of a NESHAPS for NOx emissions in CY 2000, new de-NOx technologies are being explored. This project is currently evaluating non-thermal plasma (NTP) technologies for treating jet-engine exhaust and other hazardous air pollutants. To meet a project milestone this White Paper will present our initial design options for NTP reactor systems for a field-pilot demonstration on Cruise Missile Test Cell (CMTC) exhaust at Tinker AFB. The field-pilot demonstration is necessary to provide further data and operating experience to more fully evaluate economic and performance projections for NTP de-NOx technology and to design larger systems with confidence. From the design options presented here, we will downselect the set to 2 treatment systems and consider fielding both. If the budget is not sufficient for 2 reactor systems, only one will be fielded. This paper will discuss the exhaust stream to be addressed, the test setup, the candidate reactor systems, and projected operating parameters and specifications for the field-pilot units. Because the cost and logistics of using an electron-beam NTP reactor are, respectively, too high and too complicated for this project, we have limited our candidate systems to those based on electric-discharge-driven NTP reactors (which previous economic analyses have shown to be more cost effective).

DTIC

*Nitrogen Oxides; Exhaust Emission; Pollution Control; Design Analysis; Electric Discharges; Exhaust Gases; Jet Engines; Air Pollution; Test Facilities*

14  
**LIFE SCIENCES**

*Includes life sciences (general), aerospace medicine, behavioral sciences, man/system technology and life support, and space biology.*

19990053568 Army Aeromedical Research Lab., Fort Rucker, AL USA

*A Survey of Work and Sleep Hours of US Army Aviation Personnel Final Report*

Caldwell, J. L.; Gilreath, Steven R.; Norman, David N.; Apr. 1999; 38p; In English

Contract(s)/Grant(s): Proj-30162787A878

Report No.(s): AD-A362964; USAARL-99-16; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this survey was to determine when Army aviation personnel work and sleep while on reverse cycle. A total of 157 aviation personnel from 3 Army posts were sampled. The one-page questionnaire indicated that the majority of aviation personnel had experience working night shift/reverse cycle at some point in their careers; however, over one third had not dealt with this shift for more than 3 years. Usually the night shift occurred from early in the afternoon to early in the morning, with aviators arriving home after 0800. However, a large group of responders returned home from the night shift by 0400. Although most of the responders indicated they were able to sleep after a night shift for at least 7 hours, many of them indicated they did not feel they received adequate daytime sleep most or some of the time. Although many aviators reported returning home by 0400, there is a large percentage who indicated they did not return home until after 0800, making it difficult to obtain adequate sleep. These results indicate that research is needed to address the issue of helping aviation personnel sleep during the daylight hours, both for training exercises and for deployment. Techniques for adjusting to night shift should emphasize enhanced alertness during the night with high performance and improved safety, as well as restful sleep during the day. Once the work/rest schedule for a unit is known, countermeasures to address adjustment to reversed sleep/wake cycles can be tailored to the specific needs of the individual or unit.

DTIC

*Sleep; Aircraft Pilots; Aerospace Medicine; Biological Effects; Flying Personnel; Sleep Deprivation*

19990053578 Army Aeromedical Research Lab., Fort Rucker, AL USA

*Evaluating Performance Effects of a Medication (Dexedrine) in the Simulator Versus Aircraft Environment Final Report*

Caldwell, John A.; Roberts, Kristi A.; Jones, Heber D.; Apr. 1999; 20p; In English

Contract(s)/Grant(s): Proj-30162787A879

Report No.(s): AD-A362972; USAARL-99-15; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A quasi-experimental approach assessed the pilot performance comparability of simulator versus in-flight results. Flight data from three sleep-deprivation studies were pooled. Twenty aviators were included, 10 who flew a UH-60 helicopter simulator and 10 who flew a UH-60A aircraft under the influence of Dexedrine or placebo during 40 hours of continuous wakefulness. Performance on straight and levels, right and left turns, climbs and descents, and a left-descending turn (assessed at 0100, 0500, 0900, 1300, and 1700) tended to correspond in the simulator and aircraft. Generally, performance under Dexedrine was better than under placebo. However, only half of the maneuvers showed consistent, statistically significant stimulant/fatigue effects in both flight platforms. Measurement sensitivity was lower in the aircraft, likely because of error variance due to environmental influences (weather, temperature, and turbulence) and other factors (radio traffic and anxieties about safety). Thus, actual in-flight studies, while desirable in terms of face validity, underestimate the impact of stressors such as fatigue on pilots.

DTIC

*Aerospace Medicine; Pilot Performance; Simulators; Flight Simulation; Biological Effects*

19990059465 Air Force Research Lab., Warfighter Training Research Div., Mesa, AZ USA

*Display Collimation and the Perc. of Flight Simulator Imagery Final Report, Jul. 1997 - Jun. 1998*

Pierce, Byron J., Air Force Research Lab., USA; Geri, George A., Raytheon Training and Services Co., USA; Hitt, James M., III, Raytheon Training and Services Co., USA; Aug. 1998; 36p; In English

Contract(s)/Grant(s): F41624-97-C-5000; AF Proj. 1123

Report No.(s): AD-A359409; AFRL-HE-AZ-TR-1998-0058; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Observers estimated differences in the apparent size and distance of simulated objects viewed on collimated and real-image displays. High-resolution target aircraft that remained stationary relative to the observer were superimposed on moving simulator background imagery. The aircraft were slide projections of F-15s viewed either from the side as during formation flight, or from behind and above, as during a gun pass. Both pilots and nonpilots were tested during simulated passive flight. For both the size and distance estimates, differences of 15-30% were found for formation flight at distances of 2,500; 6,000; and 9,000 ft; and differences of 10-20% were found for gun passes at distances of 1,000 and 2,000 ft. No significant differences were found in the



data obtained from the pilots and nonpilots under any of the conditions tested. The data generally confirm, for simulator imagery, that both perceived size and perceived distance are significantly reduced when imagery is displayed at viewing distances of less than about 1 m as compared to when it is displayed at or near optical infinity. The implications of magnifying real imagery displayed within about 1 m of the observer, in order to correct for the perceptual size and distance effects reported here, are discussed.

DTIC

*Human Factors Engineering; Flight Simulators; Display Devices; Collimation; Imagery*

19990053526 Defence Evaluation Research Agency, Flight Dynamics and Simulation Dept., Bedford, UK

*Wavelet Analysis of Pilot Workload in Helicopter Low-Level Flying Tasks*

Jones, J. G., Defence Evaluation Research Agency, UK; Padfield, G. D., Defence Evaluation Research Agency, UK; Charlton, M. T., Defence Evaluation Research Agency, UK; *The Aeronautical Journal*, January 1999; Volume 103, No. 1019, pp. 55-63; In English. See also 19990053521

Report No.(s): Paper-2383; Copyright, Avail. Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London W1V 0BQ, UK), Hardcopy, Microfiche

As part of a programme of research to improve mission effectiveness by studying pilot workload and task performance in mission-oriented flight tasks, a methodology has been developed in which wavelet analysis is used to extract information from records of vehicle response and of pilot control activity. By decomposing the records into discrete wavelets, components of vehicle agility and pilot workload are derived in the form of wavelet-based 'quickness' parameters for vehicle agility and go-called 'attack' parameters for pilot workload. It is shown how individual wavelet components in the records of pilot control activity, referred to as 'worklets', can be associated with the sub-tasks of 'guidance' and 'stabilisation'. It is demonstrated how these concepts can be applied to quantify changes in pilot control activity associated with increasing task difficulty or changes in aircraft handling qualities. Two examples are presented, one from a flight trial in which the task difficulty was increased by changes in a prescribed ground track and the other from a simulation trial in which an increased time delay was introduced into the response of the flight control system.

Author

*Wavelet Analysis; Pilot Performance; Workloads (Psychophysiology); Flight Control; Flight Characteristics*

19990054897 Army Research Lab., Aberdeen Proving Ground, MD USA

An Initial Assessment of the Fit, Retention, and Visual Display Characteristics of the Kaiser Proview (Trademark) Head-Mounted Display System *Final Report*

Durbin, D. B., Army Research Lab., USA; Mar. 1999; 36p; In English

Contract(s)/Grant(s): DA Proj. HL1-62716-AH-70

Report No.(s): AD-A363493; ARL-TN-135; No Copyright; Avail: CASI; A03, Hardcopy: A01, Microfiche

Head-mounted displays (HMDs) are a potentially viable technology for presentation of the "out-the-window" (OTW) scene for Army aviation simulators. As part of an effort to evaluate their suitability for Army aviation, a preliminary assessment of three Kaiser ProView (Trademark) HMDs was conducted during a simulation exercise at the U.S. Army Aviation Test Bed, Fort Rucker, Alabama. The assessment evaluated the fit, retention, and visual display characteristics of the HMDs. The method used to assess the HMDs included aviator responses to a usability survey, statistical correlation of survey responses with head measurements obtained from each aviator, observation of aviator performance during their missions, and post-mission interviews. Most of the fit, retention, and visual display characteristics of the HMDs were judged to be acceptable by the Army aviators. Suitability of the HMDs would be improved by an increase in field of view and the use of lightweight electrical cables to minimize restriction of head movement and potential for pressure-induced hot spots.

DTIC

*Display Devices; Flight Simulators; Helmet Mounted Displays; Head Movement; Statistical Correlation; Armed Forces*

19990058460 Oregon State Univ., Corvallis, OR USA

A Map Enhancement for Terrain Visualization Under Night Vision Goggle Compatible Lighting Systems

Thompson, Wiley C.; Mar. 1999; 43p; In English

Report No.(s): AD-A363413; No Copyright; Avail: CASI; A03, Hardcopy: A01, Microfiche

For the Army aviator, Night Vision Goggle (NVG) flight in the tactical rotary-wing profile is a very demanding, task saturated environment. Map navigation is just one of the many tasks that must be accomplished during flight. The dim, monochromatic lighting required for NVG flight alters map colors, decreases image detail and map feature contrast, often making terrain feature recognition more difficult. A cartographic analysis and resulting map enhancement is needed to improve feature recognition,

allowing easier navigation and safer flight. In this study, it was found that when applying a non-gray scale (magenta based) relief shading to a 1:50,000 scale military topographic line map, the surveyed aviators determined this shading improved or significantly improved their ability to visualize the terrain. It was also found that a medium level of shading (75% DEM opacity) was preferred.

DTIC

*Human Factors Engineering; Goggles; Night Vision; Aircraft Pilots; Night Flights (Aircraft); Topography*

## 15

### MATHEMATICAL AND COMPUTER SCIENCES

*Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.*

19990054589 HURECON, Smorum, Denmark

Ecological Interface Design For Complex Systems. An Example: SEAD-UAV Systems. *Final Report, Apr. 1997 - Oct. 1998* Rasmussen, Jens; Apr. 1998; 148p. In English

Report No.(s): AD-A363845; AFRL-HE-WP-TR-1999-0011; No Copyright; Avail: CASI, A07, Hardcopy; A02, Microfiche

This investigation evaluates a framework for design of ecological information systems as applied for the command and control function of Unmanned Aerial Vehicle (UAVs). In this context, the term interface design is not referring to the human computer interface, but to the interface between a decision maker and the deep relational structure of the workspace. This framework was developed for the domains of industrial process and manufacturing systems, tested through analyses of hospital and library systems, and recently further developed to model the socio-technical system involved in risk management in a modern, dynamic society. The introduction of uninhabited vehicles has raised considerable research interest, but the topics discussed have largely been related to the problems appearing when remote control of an air vehicle and its payload is introduced. Correspondingly, the system concept has been described as an effort to keep the pilots head in the cockpit and leave the rest of him at home and a literature search has shown that the human factors discussed are related mainly to display, control, and training issues.

DTIC

*Human Factors Engineering; Pilotless Aircraft; Remotely Piloted Vehicles; Adaptive Control; Automatic Flight Control*

19990053509 Georgia Inst. for Research, Atlanta, GA USA

H11-60G Mission Usage Spectrum Survey Methodology Overview

Crawford, Charlie, Georgia Inst. for Research, USA; Workshop on Helicopter Health and Usage Monitoring Systems; February 1999, pp. 57-73; In English; See also 19990053503; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., P.O. Box 4331, Melbourne, Victoria 3001, Australia); Hardcopy, Microfiche

(1) The USAF worst case spectrum defined less damaging than army estimated UH-60A/L spectrum: Survey yields less time at GW greater than 20K than any service spectrum. USAF spends more time in hover/low speed FLT. Auto entries/recoveries 235% more FLT time with training A/C. Weapons school aircraft incur most damaging FLT time. Measured GAG cycles are about half spectrum estimates. (2) The logged FLT time AVGS 15% greater than recorded FLT time, effectively reducing CRTs and increasing FLT maintenance time. (3) The ERITS is an effective tool for quantifying maneuver severity. (4) The potential impact on CRTs is positive for 9 of 10 components. (5) to reduce MR HUB CRT from 5100 to 5000 fit hrs. is a potential needs. (6) It is conservative for USAFs to continue use of UH-60A/L CRTs.

CASI

*Proc. Aures; Cycles; Damage; Hovering; Low Speed; Maintenance; Surveys*

# Subject Term Index

## A

ACCIDENT INVESTIGATION, 10  
 ACCIDENT PREVENTION, 10  
 ACOUSTIC EXCITATION, 23  
 ACTIVE CONTROL, 22  
 ACTUATORS, 22  
 ADAPTIVE CONTROL, 34  
 ADHESIVE BONDING, 15  
 AERIAL RECONNAISSANCE, 2, 8, 15  
 AEROACOUSTICS, 23  
 AERODYNAMIC BALANCE, 12, 13  
 AERODYNAMIC CHARACTERISTICS, 4, 5  
 AERODYNAMIC DRAG, 4  
 AERODYNAMIC NOISE, 23, 29  
 AERODYNAMICS, 2, 3  
 AEROELASTIC RESEARCH WINGS, 22  
 AEROELASTICITY, 4  
 AEROSERVOELASTICITY, 22  
 AEROSPACE MEDICINE, 32  
 AGING (METALLURGY), 15  
 AH-1W HELICOPTER, 14  
 AIR BREATHING ENGINES, 21  
 AIR FLOW, 4  
 AIR INTAKES, 3  
 AIR NAVIGATION, 6, 9, 11  
 AIR POLLUTION, 31  
 AIR TO AIR MISSILES, 19  
 AIR TRAFFIC CONTROL, 11  
 AIR TRANSPORTATION, 6, 10, 11  
 AIRBORNE EQUIPMENT, 17  
 AIRBORNE/SPACEBORNE COMPUTERS, 22  
 AIRCRAFT, 18  
 AIRCRAFT ACCIDENTS, 8, 10  
 AIRCRAFT CONTROL, 22  
 AIRCRAFT DESIGN, 12, 16  
 AIRCRAFT ENGINES, 20, 21  
 AIRCRAFT EQUIPMENT, 14  
 AIRCRAFT ICING, 7, 10  
 AIRCRAFT LANDING, 9  
 AIRCRAFT MAINTENANCE, 15  
 AIRCRAFT MODELS, 17, 18  
 AIRCRAFT PERFORMANCE, 9  
 AIRCRAFT PILOTS, 32, 34  
 AIRCRAFT SAFETY, 6, 7  
 AIRCRAFT SPECIFICATIONS, 9  
 AIRCRAFT STRUCTURES, 16  
 AIRFIELD SURFACE MOVEMENTS, 9

AIRFOIL PROFILES, 29  
 AIRFOILS, 3  
 AIRFRAMES, 14  
 AIRLINE OPERATIONS, 6  
 AIRPORT SECURITY, 8  
 AIRPORT SURFACE DETECTION EQUIPMENT, 9  
 AIRPORTS, 6, 7, 10, 28  
 ALGORITHMS, 2, 8  
 ALTITUDE TESTS, 23  
 ANOMALIES, 2  
 APPROACH, 9  
 ARCHITECTURE (COMPUTERS), 25  
 ARMED FORCES, 33  
 ATMOSPHERIC COMPOSITION, 31  
 ATMOSPHERIC EFFECTS, 31  
 ATMOSPHERIC MODELS, 11  
 AUTOMATED RADAR TERMINAL SYSTEM, 11  
 AUTOMATIC CONTROL, 2, 11, 13  
 AUTOMATIC FLIGHT CONTROL, 34  
 AVAILABILITY, 12

## B

BEARINGS, 30  
 BEECHCRAFT AIRCRAFT, 19  
 BIAS, 27  
 BIOLOGICAL EFFECTS, 32  
 BLUNT BODIES, 5  
 BONDED JOINTS, 15  
 BOUNDARY CONDITIONS, 5  
 BOUNDARY ELEMENT METHOD, 16  
 BOUNDARY LAYER FLOW, 5  
 BOUNDARY LAYER TRANSITION, 5  
 BOUNDARY LAYERS, 30  
 BUFFETING, 3  
 BULKHEADS, 15

## C

CAVITIES, 4  
 CENTRIFUGAL FORCE, 27  
 CHAOS, 23  
 CIVIL AVIATION, 2, 8, 31  
 COLLIMATION, 33  
 COMBUSTION PRODUCTS, 6  
 COMMERCE, 17, 24  
 COMMUNICATING, 27  
 COMPOSITE MATERIALS, 5

COMPRESSIBILITY, 5  
 COMPUTATIONAL FLUID DYNAMICS, 29  
 COMPUTERIZED SIMULATION, 15, 26, 27  
 CONFERENCES, 1, 8, 23  
 CONICAL BODIES, 5  
 CONSOLIDATION, 24  
 CONTROL SIMULATION, 22  
 CONTROL SYSTEMS DESIGN, 21, 22  
 CONTROL THEORY, 22  
 CONTROLLABILITY, 22  
 CONTROLLERS, 22  
 CORRELATION, 16  
 CORRELATION DETECTION, 6  
 COST EFFECTIVENESS, 17, 18  
 CRACK PROPAGATION, 15  
 CRACKING (FRACTURING), 15, 16  
 CRASHES, 14  
 CROSS FLOW, 5, 30  
 CRYOGENIC WIND TUNNELS, 3  
 CRYSTALS, 10  
 CYCLES, 34

## D

D-558 AIRCRAFT, 16  
 DAMAGE, 34  
 DAMAGE ASSESSMENT, 14  
 DATA ACQUISITION, 14, 28  
 DEFORMATION, 5  
 DELTA WINGS, 4  
 DESIGN ANALYSIS, 22, 30, 31  
 DETECTION, 8, 21  
 DIAGNOSIS, 2, 12, 20  
 DISPLAY DEVICES, 33  
 DISTRIBUTED INTERACTIVE SIMULATION, 19  
 DRAG, 3  
 DYNAMIC LOADS, 16  
 DYNAMIC PROGRAMMING, 15  
 DYNAMIC RESPONSE, 23  
 DYNAMIC STRUCTURAL ANALYSIS, 20

## E

EARTH IONOSPHERE, 11  
 EDUCATION, 6  
 EFFICIENCY, 24

ELECTRIC CONTROL, 29  
ELECTRIC DISCHARGES, 31  
ELECTRIC POTENTIAL, 29  
ELECTRO OPTICS, 25  
ELECTROMECHANICAL DEVICES,  
22

ELECTRONIC MODULES, 12  
ENGINE CONTROL, 14  
ENGINE TESTS, 23, 26  
EVALUATION, 17, 23  
EXHAUST EMISSION, 31  
EXHAUST GASES, 31

## F

F-16 AIRCRAFT, 19  
FAILURE, 14, 20  
FALSE ALARMS, 20  
FANS, 27  
FATIGUE (MATERIALS), 1, 16  
FATIGUE LIFE, 15  
FAULT DETECTION, 30  
FAULTS, 2, 20  
FEASIBILITY, 25  
FEEDBACK CONTROL, 22  
FIBER COMPOSITES, 5  
FIELD TESTS, 26  
FINITE ELEMENT METHOD, 21  
FINS, 5  
FIRES, 7  
FLAPPING, 30  
FLAPS (CONTROL SURFACES), 30  
FLIGHT CHARACTERISTICS, 3, 9, 33  
FLIGHT CONTROL, 22, 30, 33  
FLIGHT ENVELOPES, 22  
FLIGHT PATHS, 6  
FLIGHT PLANS, 15  
FLIGHT RECORDERS, 12  
FLIGHT SAFETY, 12  
FLIGHT SIMULATION, 15, 22, 32  
FLIGHT SIMULATORS, 33  
FLIGHT TESTS, 9, 22, 25  
FLOW MEASUREMENT, 27  
FLOW VISUALIZATION, 4, 29  
FLUID DYNAMICS, 3  
FLYING PERSONNEL, 32  
FREQUENCIES, 27, 28  
FUSELAGES, 23

## G

GAS TURBINE ENGINES, 20  
GAS TURBINES, 20, 26  
GENERAL AVIATION AIRCRAFT, 10

GLOBAL POSITIONING SYSTEM, 11,  
12, 25  
GLOBAL WARMING, 7  
GOGGLES, 34

## H

H-INFINITY CONTROL, 22  
HARDWARE IN THE LOOP SIM-  
ULATION, 19  
HARMONIC EXCITATION, 29  
HEAD MOVEMENT, 33  
HEALTH, 12, 13, 14  
HEAT TRANSFER, 3  
HELICOPTERS, 2, 4, 12, 13, 14, 30  
HELMET MOUNTED DISPLAYS, 33  
HEURISTIC METHODS, 15  
HIGH SPEED, 3  
HISTORIES, 16  
HOMING DEVICES, 17  
HOVERING, 34  
HUMAN FACTORS ENGINEERING,  
33, 34  
HYDRAULIC EQUIPMENT, 22  
HYDROCARBON FUELS, 21  
HYDROGRAPHY, 4  
HYPERSONIC FLOW, 5  
HYPERSONIC VEHICLES, 5

## I

ICE FORMATION, 7, 10  
ICE PREVENTION, 10  
IMAGE RESOLUTION, 25  
IMAGERY, 33  
IMPACT TESTS, 19  
IN-FLIGHT MONITORING, 7  
INCOMPRESSIBLE FLOW, 29  
INERTIAL NAVIGATION, 30  
INFORMATION SYSTEMS, 27  
INSTALLING, 12  
INSTRUMENT LANDING SYSTEMS,  
19

## J

JAVA (PROGRAMMING LAN-  
GUAGE), 15  
JET AIRCRAFT, 8  
JET ENGINES, 31

## L

LANDING AIDS, 19

LANDING GEAR, 28, 29  
LANDING INSTRUMENTS, 29  
LASER GYROSCOPES, 30  
LIFE (DURABILITY), 14  
LOGISTICS, 17, 18  
LOGISTICS MANAGEMENT, 17  
LOW SPEED, 34  
LOW VISIBILITY, 9  
LUBRICATING OILS, 20

## M

MAGNETIC INDUCTION, 29  
MAINTAINABILITY, 12  
MAINTENANCE, 34  
MANAGEMENT SYSTEMS, 12, 23, 24  
MANUFACTURING, 26  
MATHEMATICAL MODELS, 4, 30  
MECHANICAL DEVICES, 28, 30  
MESOSCALE PHENOMENA, 10  
METAL SURFACES, 15  
MIDAIR COLLISIONS, 8  
MILITARY HELICOPTERS, 1, 13  
MISSILE TESTS, 19  
MODELS, 26  
MONITORS, 1, 12, 13, 14  
MULTIPATH TRANSMISSION, 19

## N

NAVIER-STOKES EQUATION, 4, 5  
NAVIGATION, 11  
NAVIGATION AIDS, 6  
NAVIGATION INSTRUMENTS, 30  
NIGHT FLIGHTS (AIRCRAFT), 34  
NIGHT VISION, 34  
NITROGEN OXIDES, 31  
NOISE MEASUREMENT, 5  
NONEQUILIBRIUM FLOW, 5  
NONINTRUSIVE MEASUREMENT, 20  
NONLINEARITY, 22  
NUMERICAL ANALYSIS, 27

## O

OBJECT-ORIENTED PROGRAM-  
MING, 15  
OPTICAL TRACKING, 25  
OSCILLATIONS, 4  
OZONE DEPLETION, 31

## P

PANEL FLUTTER, 23



PARABOLIC BODIES, 5  
 PARTICLE MASS, 10  
 PERFORMANCE PREDICTION, 12  
 PERFORMANCE TESTS, 2, 4, 9, 17, 23, 27  
 PHYSICAL EXERCISE, 27  
 PIEZOELECTRICITY, 21  
 PILOT PERFORMANCE, 32, 33  
 PILOTLESS AIRCRAFT, 15, 34  
 PLANNING, 7  
 POLLUTION CONTROL, 31  
 POSTFLIGHT ANALYSIS, 13  
 PRESSURE DISTRIBUTION, 4  
 PROBABILITY THEORY, 15  
 PROCEDURES, 27, 34  
 PRODUCT DEVELOPMENT, 25  
 PRODUCTION MANAGEMENT, 22  
 PRODUCTIVITY, 24  
 PROJECT PLANNING, 8  
 PROPULSION SYSTEM CONFIGURATIONS, 21  
 PROPULSION SYSTEM PERFORMANCE, 21  
 PROVING, 26

## R

RADAR DETECTION, 7  
 RANGES (FACILITIES), 23, 27  
 RECEIVERS, 12  
 REGULATIONS, 10  
 RELATIVITY, 12  
 REMOTE CONTROL, 30  
 REMOTE SENSING, 7  
 REMOTELY PILOTED VEHICLES, 34  
 REQUIREMENTS, 9  
 RESEARCH, 4  
 RESEARCH FACILITIES, 23, 25  
 RESEARCH MANAGEMENT, 24  
 RESIDUAL STRESS, 15  
 RETARDING, 22  
 REYNOLDS NUMBER, 23  
 RISK, 9, 15  
 ROBOTS, 21  
 ROTARY WINGS, 13  
 ROTOR BLADES (TURBOMACHINERY), 3  
 ROTORS, 29  
 ROUTES, 15  
 RUNWAYS, 6

## S

SAFETY, 2, 6, 8  
 SAFETY MANAGEMENT, 6, 10, 11

SCALE MODELS, 4  
 SCATTERING, 19  
 SCINTILLATION, 17  
 SECURITY, 8  
 SEPARATED FLOW, 3  
 SH-3 HELICOPTER, 13  
 SHOCK WAVES, 3  
 SHOT PEENING, 15  
 SIDEBANDS, 30  
 SIMULATION, 25  
 SIMULATORS, 32  
 SLEEP, 32  
 SLEEP DEPRIVATION, 32  
 SLENDER CONES, 5  
 SLOTS, 29  
 SNOW, 10  
 SPACE SHUTTLE ORBITERS, 28  
 SPACECRAFT COMPONENTS, 28  
 SPACECRAFT LANDING, 28  
 SPECTRUM ANALYSIS, 30  
 STABILIZERS (FLUID DYNAMICS), 19  
 STATISTICAL ANALYSIS, 10  
 STATISTICAL CORRELATION, 33  
 STRATOSPHERE, 31  
 STRESS FUNCTIONS, 5  
 STRESS MEASUREMENT, 15  
 STRUCTURAL ANALYSIS, 5, 15  
 STRUCTURAL ENGINEERING, 5  
 STRUCTURAL FAILURE, 16, 21  
 STRUTS, 16  
 SUPERSONIC COMMERCIAL AIR TRANSPORT, 31  
 SUPERSONIC SPEED, 4  
 SURVEILLANCE, 9  
 SURVEILLANCE RADAR, 9  
 SURVEYS, 34  
 SWEEP WINGS, 30  
 SYSTEM EFFECTIVENESS, 8  
 SYSTEMS ANALYSIS, 9  
 SYSTEMS ENGINEERING, 21, 28  
 SYSTEMS MANAGEMENT, 24

## T

TARGET DRONE AIRCRAFT, 17  
 TAXIING, 9  
 TECHNOLOGY ASSESSMENT, 23, 26  
 TEST FACILITIES, 23, 25, 26, 27, 31  
 TEST RANGES, 23, 24  
 THEODOLITES, 25  
 THRUST AUGMENTATION, 20  
 TOPOGRAPHY, 34  
 TRAINING AIRCRAFT, 6  
 TRAINING DEVICES, 27

TRANSITION FLOW, 5, 30  
 TRANSMISSIONS (MACHINE ELEMENTS), 30  
 TRANSONIC FLOW, 2, 27  
 TRANSONIC FLUTTER, 22  
 TRANSONIC SPEED, 16  
 TRANSPORT AIRCRAFT, 31  
 TRANSPORTATION, 7, 11  
 TRAVELING SALESMAN PROBLEM, 15  
 TRAVELING WAVES, 30  
 TURBOJET ENGINES, 20  
 TURBORAMJET ENGINES, 20  
 TURBULENT BOUNDARY LAYER, 23  
 TURBULENT FLOW, 4  
 TWO DIMENSIONAL FLOW, 29

## U

UNSTEADY AERODYNAMICS, 3, 22  
 UNSTEADY FLOW, 2, 3  
 USER MANUALS (COMPUTER PROGRAMS), 15

## V

VELOCITY DISTRIBUTION, 28, 30  
 VIBRATION, 13

## W

WALLS, 27  
 WARNING SYSTEMS, 6  
 WAVE DISPERSION, 28  
 WAVELET ANALYSIS, 2, 33  
 WEAPON SYSTEMS, 17  
 WIND SHEAR, 8  
 WIND TUNNEL APPARATUS, 30  
 WIND TUNNEL MODELS, 29, 30  
 WIND TUNNEL TESTS, 4, 22  
 WORKLOADS (PSYCHOPHYSIOLOGY), 2, 33



# Personal Author Index

## A

Abeyratne, R. I. R., 8  
Adamsen, Anthony, 17, 18  
Allendoerfer, Kenneth R., 11  
Anderson, James G., 31  
Ashby, N., 11

## B

Bakuckas, J. G., 16  
Baldwin, B. F., 2  
Baughcum, Steven L., 31  
Berens, Alan P., 14  
Bird, Jeff W., 20  
Bisbee, T. S., 30  
Blunt, David, 13  
Borowiec, J. D., 7  
Botes, C. J., 14  
Braig, Wolfgang, 25  
Bright, Charles B., 22  
Brock, Charles A., 31  
Brune, William H., 31  
Buck, J. K., 17  
Burski, Michael L., 26

## C

Caldwell, J. L., 32  
Caldwell, John A., 32  
Cant, Robert, 13  
Carter, John, 22  
Cassell, Rick, 9  
Chang, J. S., 31  
Charlton, M. T., 33  
Cohen, Ronald C., 31  
Collins, Peyton, 21  
Crawford, Charlie, 34

## D

Dagenhart, J. Ray, 29  
Delery, J. M., 3  
Dighton, Robert, 26  
Dobrin, Lawrence L., 13  
Dowell, Earl H., 4  
Draper, Alan, 1  
Dresser, G. B., 7  
Durbin, D. B., 33

## E

Edwards, Craig D., 4, 29  
Edwards, J. A., 3  
Egalon, Claudio, 5  
Ellis, William, 25  
Evers, Carl, 9

## F

Fobes, J. L., 8  
Forsyth, Graham F., 1  
Fry, Ronald S., 20

## G

Gajzer, Matej, 28  
Galushka, Joseph, 11  
Gannaway, Mary T., 20  
Gao, Yujin, 30  
Geri, George A., 32  
Gill, John, 12  
Gilreath, Steven R., 32  
Goodberlet, M., 7  
Goswami, Kisholoy, 5

## H

Hadland, Peter C., 7  
Hackaday, Gary L., 20  
Hahkio, T. L., 19  
Hammer, Natalie, 22  
Hancock, P. E., 27  
Hansen, Christopher P., 28  
Hardman, Bill, 1  
Havinga, M. C., 14  
Hermann, Bruce R., 11  
Hess, Andrew J., 1  
Hicok, Dan, 9  
Hitt, James M., III, 32  
Ho, T., 27  
Hovey, Peter W., 14  
Howard, Paul L., 19  
Howe, M. S., 29  
Humley, J. D., 16  
Hunter, D. R., 6  
Huntington, John, 7

## J

Jablonski, Richard L., 24  
Jeck, R. K., 9  
Jensen, R. S., 6  
Jensen, Scott A., 28  
Johnson, A. E., 27  
Jones, Heber D., 32  
Jones, J. G., 33

## K

Kawa, S. Randolph, 31  
Kennon, J. E., 30  
King, Steven R., 28  
Kinnison, Douglas F., 31  
Klock, B. A., 8

## L

Lee, Detrick, 9  
Lee, R. N., 16  
Lees, Jonathan, 25  
Leshem, Aaron, 24  
Lieberman, Robert, 5  
Lind, Rick, 22  
Little, D., 20  
Lombardo, Domenico, 13  
Loomis, John S., 14

## M

Malvey, D. G., 2  
MacLeod, J. D., 20  
Maestrello, L., 23  
Male, C. S. C., 7  
McGuire, R. J., 19  
McKee, Larry, 18, 24  
McLean, D., 8  
Mead, J. B., 7  
Mendoza, Edgar, 5  
Menrath, Martin, 25  
Merten, Ralph, 25  
Miziolex, A. W., 31  
Mochalov, A. V., 30  
Mogford, Richard H., 11  
Mowbray, Keith, 12  
Mukhopadhyay, Vivek, 21  
Mulligan, M. F., 20

## N

Narang, B. S., 27  
Neddlerman, William H., Jr., 1  
Newman, Paul A., 31  
Newman, William E., 24  
Norman, David N., 32

## O

Olsson Jacques, Christina, 15  
O'Neill, Peter, 13  
ORourke, Kevin P., 15

## P

Padfield, G. D., 33  
Pazmany, A., 7  
Pierce, Byron L., 32  
Pitlich, Nancy D., 5  
Pollard, Raymond G., III, 27  
Price, J. A., 2

## Q

Qin, N., 3

## R

Raimondo, Nat., 25  
Rakovan, Lori, 6  
Randall, R. B., 30  
Rasmussen, Jens, 34  
Rasocha, L. A., 31  
Reblrecht, Brian, 13  
Reed, Helen L., 5  
Reintjes, John, 19  
Rigden, Chris, 23  
Rix, Glenn J., 28  
Roberts, Kristi A., 32  
Rodriguez, Jose M., 31  
Rognan, Melanie, 20

## S

Saric, William S., 29  
Saxena, Indu, 5  
Schmidt, Klaus J., 25  
Shaw, S. L., 3  
Slemik, Bojan, 28  
Smith, Alex, 9  
Smith, Mark E., 24  
Stefanko, Stjepan, 28  
Stephenson, Mark, 22  
Stevenson, Todd E., 27  
Stolarski, Richard S., 31  
Stollery, J. L., 2  
Stollery, John L., 2

## T

Tarjan, Fabry, M., 5  
Thompson, Wiley C., 33  
Towning, J. N., 17  
Trammel, Charles, 12  
Travis, Peter, 25  
Tribble, Dorothy J., 17, 18

## V

Vossler, Gerald, 12  
Vu, T., 19

## W

Walston, Jennifer G., 15  
Waugh, Darryn, 31  
Weiss, M., 11  
Wettl, F., 5  
White, David, 14  
Wiesenhahn, David, 26  
Wiggins, M. W., 6  
Willink, M. P., 30  
Wofsy, Steven C., 31

## Y

Yedavalli, R. K., 21

## Z

Zagradisnik, Ivan, 28  
Zhang, X., 3  
Zouanol, Z., 8





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